A New 1947

ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

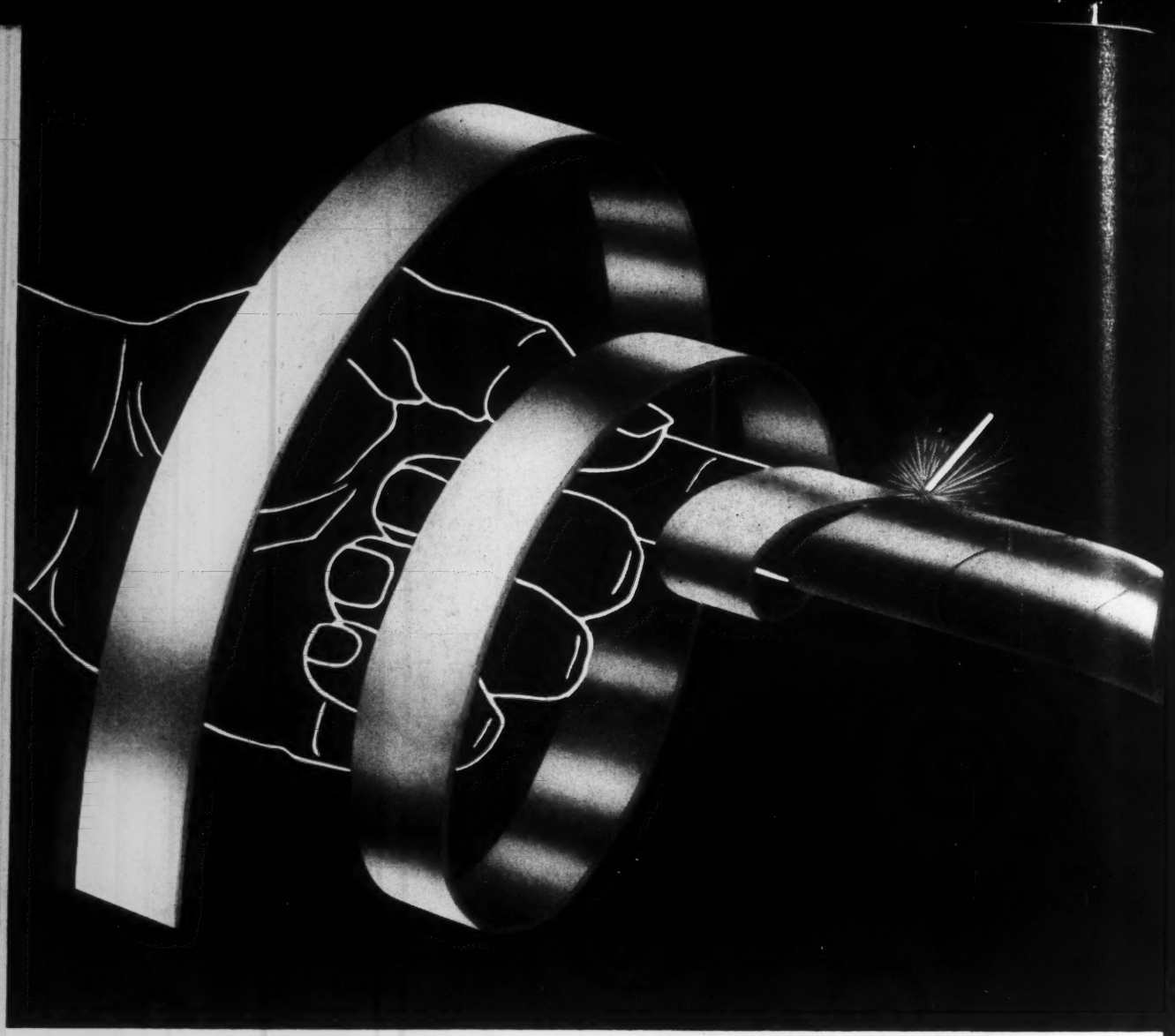
APRIL 3, 1947

Dredge removes final earth plug in cutoff pilot channel at Hopedale Bend, as Army engineers work to control Arkansas River

...Y DESIGNED FOR RESIDENTIAL AREA

...OIL SURVEYS DEMAND PRIOR ...

...APY ROADS SURFACED WITH ...



It twists steel around its finger

A flat ribbon of steel slips into an automatic machine. A twist, a weld, and it emerges as ARMCO Steel Pipe—one of the world's finest pipes for water and gas lines, process piping, foundation piling, dredge pipe, and many other uses.

This Armco-developed pipe has special advantages for engineers and contractors. The spiral method of fusion welding assures exceptional straightness and resistance to external crushing forces—the pipe is uniformly strong. There are no flaws because the patented method of manufacturing permits visual inspection of both sides of the pipe wall. It also makes available a full range of diameters from 6 to 36 inches and wall thicknesses from 7/64 to 1/2 inch. And ARMCO Pipe can be supplied with a wide variety of coatings and linings.

This is only one of the many products pioneered by Armco during the past 40 years to meet specific applications. Armco men are backed by experience, extensive research facilities, and a real interest in helping solve drainage and construction problems.

These are some of the reasons it will pay you to bring your problems to Armco. Here you will find a complete range of engineered products and convenient authoritative data in every field—highway, railway, municipal and industrial. If your problem is unusual, why not talk it over with one of our specialized engineers.

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Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Canals, Tunnels, Railroads

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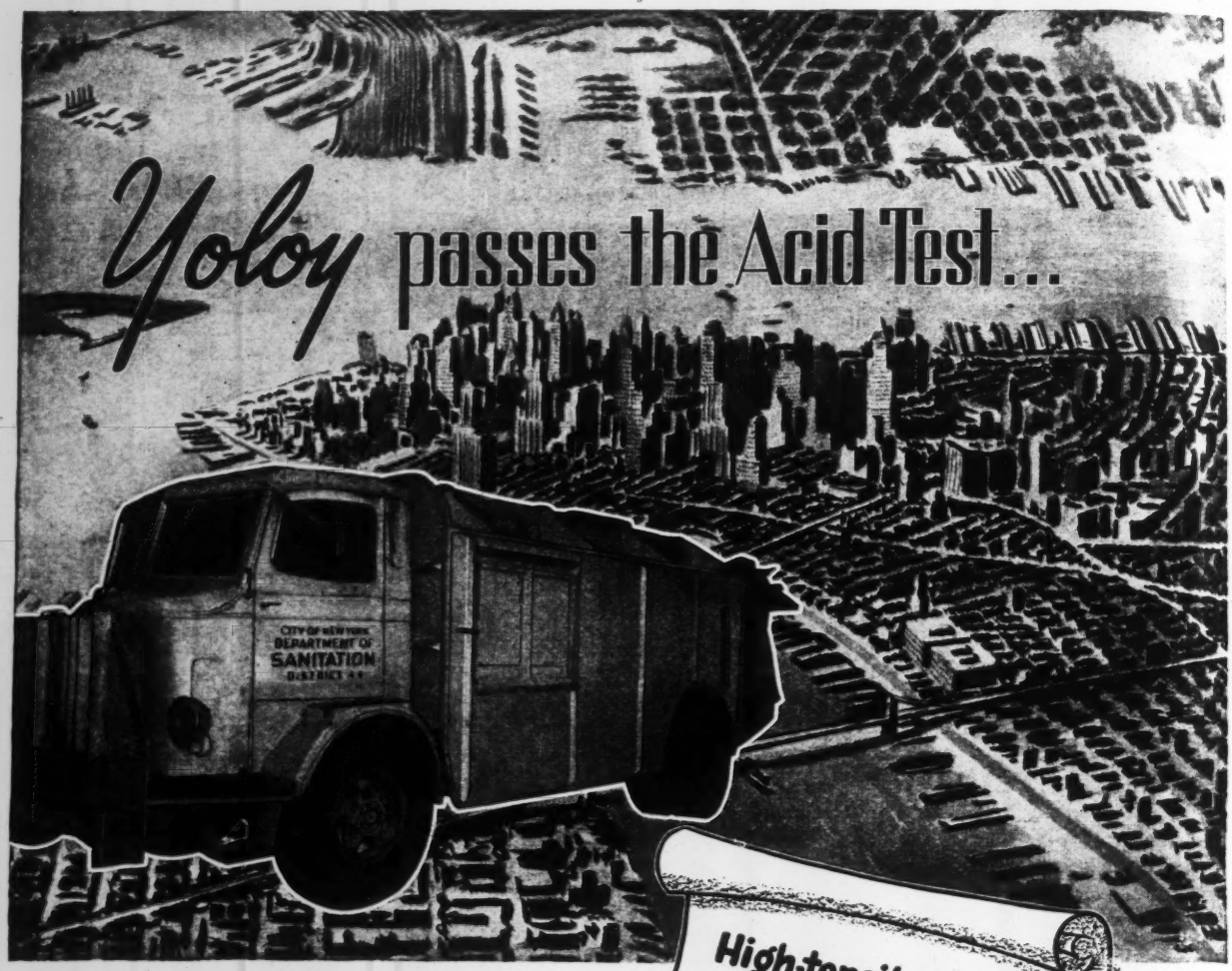

High-tensile truck bodies prove they can "take it"

AFTER nine years of the hardest kind of service, here is a garbage truck still in excellent condition. Its body is high-tensile steel.

Previously, New York City's garbage trucks were built with carbon steel bodies. Usually they had to be repaired every 6 to 12 months. To eliminate this condition high-tensile corrosion resisting steel was specified. These ran for years without repairs, and since then repairs have been minor--confined to replacement of bottom parts worn out by abrasion. There have been no failures due to corrosion.

Yoloy is Youngstown's nickel-copper low-alloy steel. Its corrosion-resistant characteristics are outstanding. It is also unusually tough and strong, with excellent welding properties. This makes Yoloy ideal for construction where it is important to reduce dead weight, and where long, trouble-free service, even under adverse conditions, is important.

Yoloy, Youngstown's high-tensile steel, is produced in plates, sheets, strip, bars, shapes, seamless and electric weld pipe.

Acids, moisture and other corrosive matter have not seriously affected the high-tensile steel garbage truck body shown above.

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Construction Trends

1946 Sewerage Contracts 229% Above a Year Ago

The cumulative total of sewerage construction contract volume, as reported by Engineering News-Record, rose to $113,589,000 in 1946, the highest volume recorded since 1939 with the exception of the 1942 volume of $118,700,000. The 1946 contract volume showed a gain of 229 percent over the 1945 volume of $34,560,000 and 255 percent over the wartime low of $31,979,000 reached in 1944.

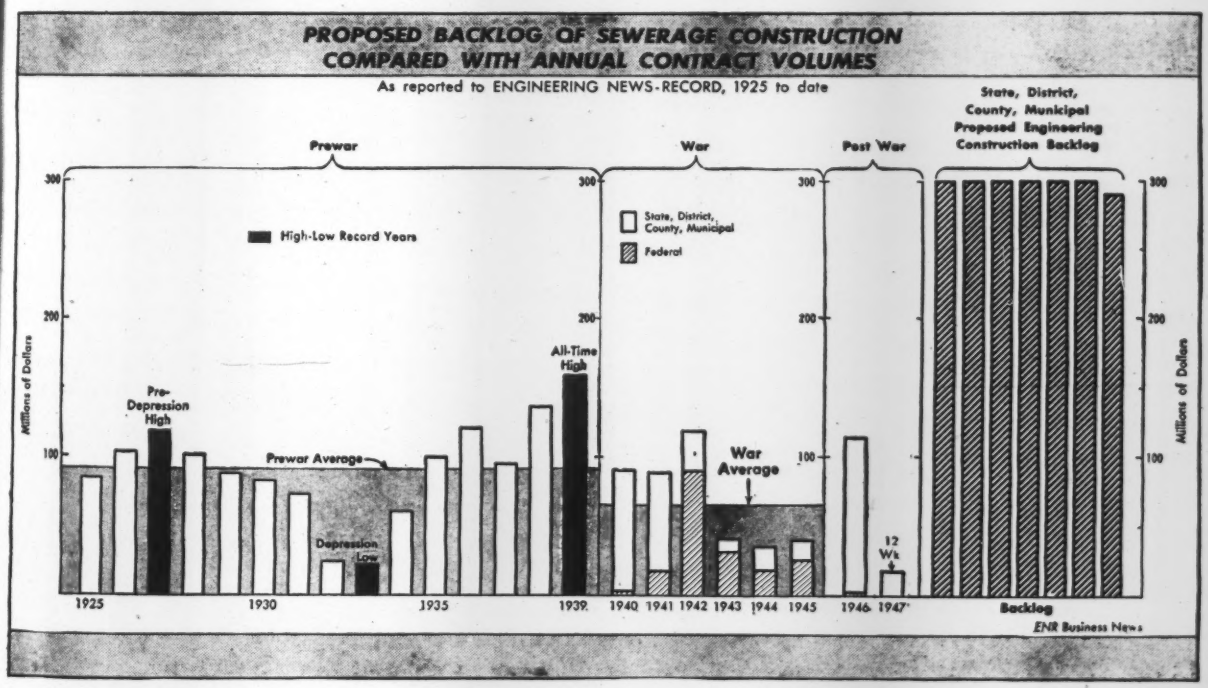
The dollar volume of sewerage construction during 1946 was almost entirely accounted for by state, district, county, and municipal construction. During the four preceding war years, federal construction predominated, accounting for approximately 75 percent of total sewerage construction in 1942 and 1943, 50 percent of the 1944 total and 60 percent of the 1945 total.

As compared with prewar years, 1946 sewerage contract volume, although still 29 percent below the all-time high of $159,500,000 reached in 1939, rose 24 percent above the prewar average of $91,440,000.

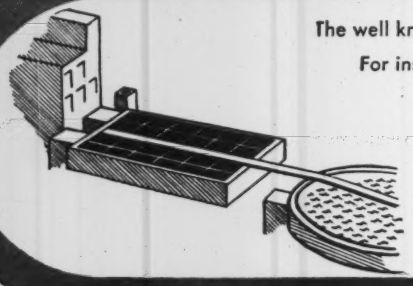
Figures available so far in 1947 total $19,324,000 for the first twelve weeks, compared with $9,668,000 in the corresponding period of 1946, a gain of 100 percent. The weekly average per month for January, 1947 of $1,587,000 rose 223 percent over the January, 1946 average of $491,000, and the February, 1947 average of $2,006,000 rose 150 percent over the February, 1946 average of $802,000. The average of $1,123,000 for the first three weeks of March, 1947, however, dropped 16 percent below the corresponding March, 1946 average, but a prolonged contraction of sewerage construction is not yet indicated.

The cumulative backlog of proposed sewerage construction through February, 1947 is at the record level of $2,091,328,000, more than thirteen times the 1939 all-time high rate of sewerage construction activity. This total is conservative since proposed construction has been entered at cost estimates based on 1940, 1943, 1944, 1945, and 1946 prices and wages. How these costs have increased is indicated by the Engineering News-Record construction cost index, on the basis of 1913 as 100, which averaged 242 in 1940 and climbed to 392 by March, 1947, a rise of 62 percent.

States which have the largest backlog of proposed sewerage construction on record at recorded cost estimates, are: New York, $297,355,000; Pennsylvania, $199,703,000; Illinois, $194,840,000; California, $178,053,000; Michigan, $151,707,000; Ohio, $149,908,000; Texas, $104,342,000; New Jersey, $80,846,000; Massachusetts, $66,936,000; Florida, $64,111,000; Indiana, $62,867,000; Tennessee, $46,444,000; Missouri, $40,600,000; Connecticut, $40,156,000; Washington, $34,862,000.



CONSIDER THE RULE OF 3 IN YOUR PLANNING



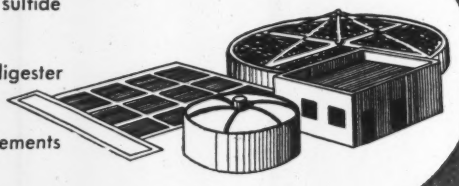
The well known rule of three applies in chlorination as well as it does in mathematics.

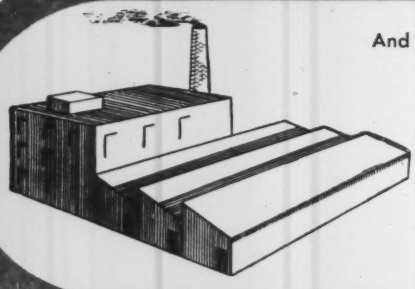
For instance, water plants need —

1. *Prechlorination* for improved coagulation, color removal, algal control, etc.
2. *Plant chlorination* for increased filter runs, sterilization, manganese removal and increased plant efficiency.
3. *Post chlorination* for taste and odor control and elimination of gas-formers throughout the system.

Sewage plants, too, need —

1. *Interceptor chlorination* for odor control, reduction of hydrogen sulfide damage to concrete structures and prevention of septicity.
2. *Plant chlorination* for odor control, prevention of sludge bulking, digester super-natant treatment, prevention of filter ponding, etc.
3. *Effluent chlorination* for sterilization to meet stream pollution requirements and prevent damage to recreation areas.





And Industrial plants need —

1. *Process Water chlorination* for quality control and elimination of spoilage losses.
2. *Cooling Water chlorination* for increased heat exchanger efficiency and reduced labor costs.
3. *Waste Water chlorination* to facilitate disposal of objectionable mill-waste products.

Thus, In your planning for any plant, consider the three time use of chlorination for a more flexible, better equipped plant with the low cost "room for expansion" that only chlorination can give.

A wealth of new information on the uses of chlorination is yours for the asking and any W & T Chlorination Specialist will be glad to assist you on your chlorination problems. Call on them freely.

WALLACE & TIERNAN COMPANY, INC.

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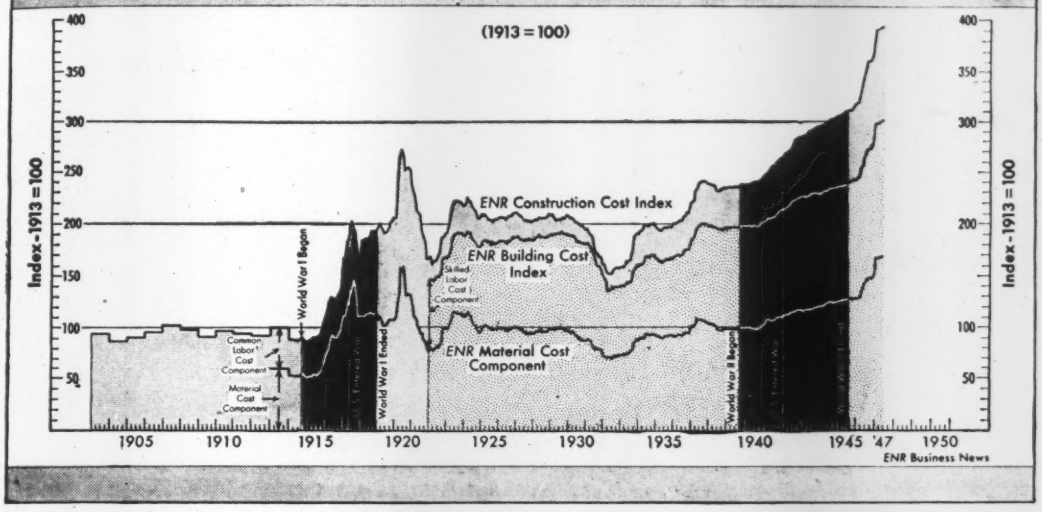
S-2

APRIL CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	March 1946 (4 wk.)	March 1947 (4 wk.)	% Change	Three Months 1946 (13 wk.)	Three Months 1947 (13 wk.)	% Change
Total U. S. Construction	$383,981	$400,415	+4	$980,283	$1,187,876	+21
Private Construction	247,297	286,049	+16	653,390	794,531	+22
Public Construction	136,684	114,366	−16	326,893	393,345	+20
Federal	43,279	15,547	−64	109,925	87,492	−20
E N R Construction Volume Index, 1913 = 100	256	220	−14	204	204	0
Total New Productive Capital	55,565	72,999	+31	357,218	256,004	−28
Private Investment	55,565	72,999	+31	198,898	256,004	+29
Federal (non-federal work)	.....	.....	.....	.....	.....	.....
Federal (federal work)	.....	.....	.....	158,320	.....	.....

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Apr., 1947	396.09	190.40	300.81	162.61	....	....
Mar., 1947	391.93	188.40	298.82	161.53	220	96
Feb., 1957	390.76	187.84	297.38	160.75	197	86
Jan., 1947	381.68	183.47	288.78	156.11	195	86
Dec., 1946	368.10	176.95	278.49	150.54	207	91
Nov., 1946	362.47	174.24	273.71	147.96	164	72
Oct., 1946	360.94	178.50	272.74	147.43	233	102
Sept., 1946	360.19	173.14	272.04	147.06	233	98
Aug., 1946	361.37	173.71	271.98	147.02	258	113
July, 1946	353.89	170.11	266.13	143.86	327	144
June, 1946	347.91	167.24	264.16	142.80	344	151
May, 1946	339.69	163.29	257.25	139.06	284	125
1946 (Av.)	345.74	166.19	261.87	141.55	250	110
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	95	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77

CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	April 1946	April 1947	% Change	Change March to April 1946 Mar.	1946 Apr.	1946 %	1947 Mar.	1947 Apr.	1947 %
E N R Constr. Cost Index†	334.59	396.09	+18.38	323.83	334.59	+3.3	391.95	396.09	+1.06
E N R Building Cost Index†	254.37	300.81	+18.26	245.41	254.37	+3.6	298.84	300.81	+0.66

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	April 1946	April 1947	% Change	Change March to April 1946 Mar.	1946 Apr.	1946 %	1947 Mar.	1947 Apr.	1947 %
Common Labor	$1.004	$1.138	+13.35	$0.988	$1.004	+1.6	$1.123	$1.138	+1.34
Skilled Labor (Av. 3 Trades)	1.762	1.935	+9.82	1.743	1.762	+1.1	1.923	1.935	+0.62
Bricklayers	1.881	2.078	+10.47	1.839	1.881	+2.3	2.061	2.078	+0.82
Structural Ironworkers	1.786	1.937	+8.45	1.771	1.786	+0.8	1.924	1.937	+0.68
Carpenters	1.620	1.786	+10.25	1.618	1.620	+0.1	1.779	1.786	+0.39
Reinforcing Steel, cwt.	3.015	3.682	+22.12	2.79	3.015	+8.3	3.570	3.682	+3.14
Structural Steel, base	2.3175	2.50	+7.87	2.10	2.35	+11.9	2.50	2.50	0.0
Sand, per ton	1.36	1.693	+24.49	1.33	1.36	+2.3	1.684	1.693	+0.53
Lumber, 2x4 Fir, per M ft.	57.85	83.968	+45.15	55.66	57.85	+3.9	82.593*	83.968	+1.66
Lumber, 2x4 Pine, per M ft.	54.86	81.912	+49.31	54.46	54.86	+0.7	81.132	81.912	+0.96
Common brick, per M	26.20	22.829	−12.87	20.33	26.20	+28.8	22.829	22.829	0.0
Ready-mixed concrete, c.y.	7.80	8.867	+13.68	7.64	7.80	+2.1	8.842	8.867	+0.28
Struct. clay tile, 3x12x12	97.38	107.81	+10.71	90.23	97.38	+7.9	107.293	107.81	+0.48

* *Revised.*

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	March 1946	March 1947	% Change	February 1947	% Change February to March
Steel (% operating Capacity) A.I.S.I.	84.4	95.9*	+14	93.7	+2

	January 1946	January 1947	% Change	Twelve Months 1945	Twelve Months 1946	% Change
Cement, thous. bbl. U.S.B. of Mines	7,391	8,363	+13	106,400	169,336	+59

	February 1946	February 1947	% Change	Two Months 1946	Two Months 1947	% Change
Fabricated Structural Steel, tons, A.I.S.C.	45,754	123,148	+169	132,125	252,535	+91
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$198,687	$166,545	−16	$402,739	$323,077	−20

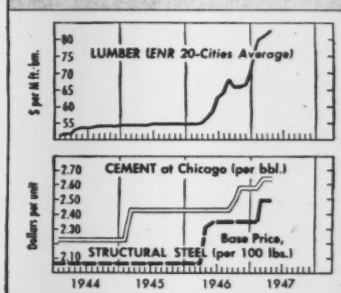
* *Four weeks average.*

COST OF LIVING INDEX . . . . EMPLOYMENT

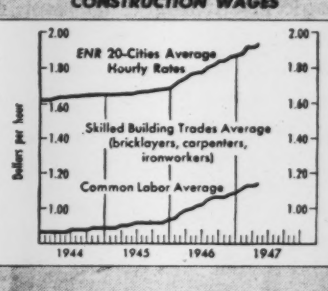
	February 1946	February 1947	% Change	January 1947	% Change January to February
Consumers' Price Index, B L S	129.6	152.8	+17.9	153.1	−0.2
Rent (Housing) Index, B L S	108.3	108.9	+0.6	108.8	+0.1

	March 1946	March 1947	% Change	February 1947	% Change February to March
Const. Employment (est.), thous., B L S	1,497	1,605	+7.2	1,539	+4.3
Private Const. Employ. (est.), thous., B L S	1,316	1,290	−2.0	1,628	−20.8

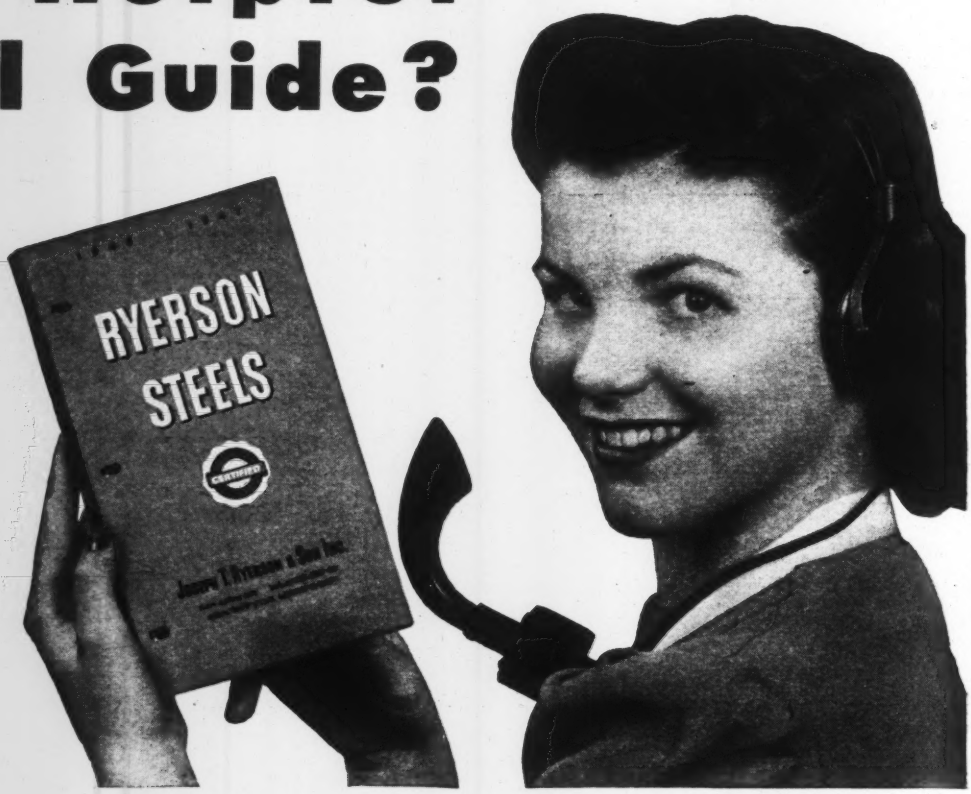
MATERIAL COST PRICES



CONSTRUCTION WAGES



Are You Using this Helpful Steel Guide?



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RYERSON STEEL

New Construction Volume in March

Civil engineering construction volume in continental United States totals $400,415,000 for March, an average of $100,104,000 for each of the four weeks of the month. This average is 12 percent above the February average, and 4 percent above the average of March, 1946, according to *Engineering News-Record*.

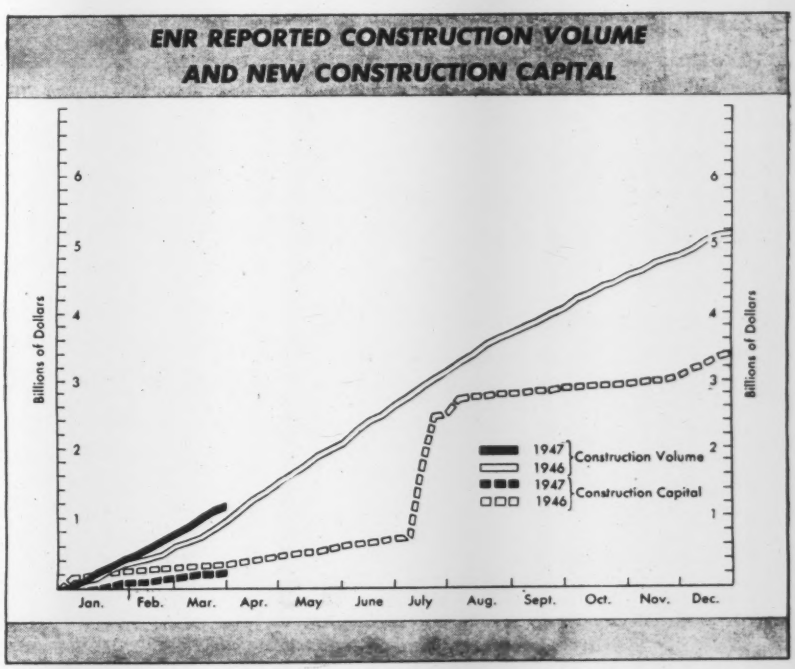
Private construction for March on a weekly average basis is 25 percent above last month, and 16 percent greater than March, 1946. Public construction is 11 percent below last month and 16 percent below last March. State and municipal construction is 0.4 percent below last month, but 6 percent above the average for March, 1946. Federal construction, down 46 percent from last month, is 64 percent below March, 1946.

Weekly averages in the various classes of construction for March, 1947 compared with February, show gains in commercial buildings of 19 percent; highways, 24 percent; waterworks, 97 percent; and private unclassified, 98 percent; losses in public buildings, 1 percent; industrial buildings, 2 percent; public bridges, 8 percent; sewerage, 45 percent; earthwork and drainage, 48 percent; and public unclassified, 70 percent.

Geographically, four sections showed gains in March, 1947 over February—South, 6 percent: Middle Atlantic, 16 percent; Far West, 31 percent; and Middle West, 55 percent. New England dropped 8 percent below February, and West of the Mississippi, 17 percent.

Three sections made gains in March over March, 1946—Middle Atlantic, 2 percent; Middle West, 70 percent; and South, 85 percent. West of the Mississippi dropped 15 percent below last year, New England, 18 percent; and Far West, 27 percent.

New capital for construction purposes for the four weeks of March, 1947 totals $72,999,000, or a weekly average of $18,250,000, 2 percent below the February, 1947 average, and 31 percent above the average for March, 1946.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—MARCH, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

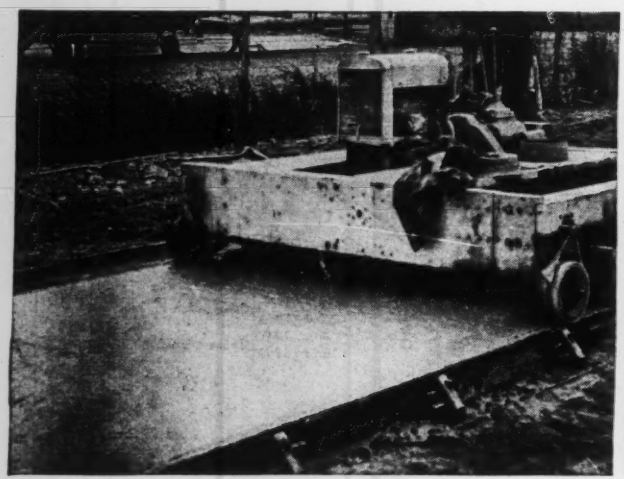
For Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States March 1947	United States Three Months 1947	United States Three Months 1946	Canada
Public Works										
Waterworks	835	895	871	1,895	1,358	2,438	8,292	27,360	26,968	1,171
Sewerage	110	946	333	628	1,124	1,278	4,419	20,375	12,156	693
Bridges, public	.....	1,340	3,679	2,088	3,796	1,131	12,034	34,660	23,289	1,360
Earthwork and waterways	1,165	236	1,955	101	1,232	2,171	6,860	28,773	69,665	188
Streets and roads	1,427	8,934	14,807	3,744	11,661	5,620	46,193	122,077	111,830	1,023
Buildings, public	1,101	8,999	5,473	3,177	1,882	9,418	30,050	111,947	60,749	3,174
Unclassified, public	418	695	2,230	695	1,759	721	6,518	48,153	22,236	596
Total public	**5,056**	**22,045**	**29,348**	**12,328**	**22,812**	**22,777**	**114,366**	**393,345**	**326,893**	**8,205**
Federal government (included in above classifications)	1,120	4,352	3,396	423	3,709	2,547	15,547	87,492	109,925	.....
Private										
Bridges, private	.....	.....	73	.....	350	.....	423	423	1,100	250
Industrial buildings	3,238	21,869	5,358	6,936	13,224	5,245	55,870	190,779	253,911	20,291
Commercial buildings	7,910	58,278	28,778	11,023	11,899	46,148	164,036	489,962	360,050	1,150
Unclassified, private	640	154	6,027	35,042	21,237	2,620	65,720	113,367	38,329	100
Total private	**11,788**	**80,301**	**40,236**	**53,001**	**46,710**	**54,013**	**286,049**	**794,531**	**653,390**	**21,791**
Total Engineering Construction:										
March, 1947 — 4 weeks	**16,844**	**102,346**	**69,584**	**65,329**	**69,522**	**76,790**	**400,415**	.....	.....	**29,996**
February, 1947 — 4 weeks	18,291	88,047	65,370	42,184	84,059	58,540	356,491	.....	.....	38,345
March, 1946 — 4 weeks	20,426	100,534	37,598	38,466	81,675	105,282	383,981	.....	.....	17,262
Three Months — 1947	**48,888**	**327,533**	**207,922**	**151,267**	**228,237**	**224,029**	.....	**1,187,876**	.....	**106,266**
Three Months — 1946	76,771	207,415	108,140	119,724	208,726	259,507	.....	.....	980,283	71,314

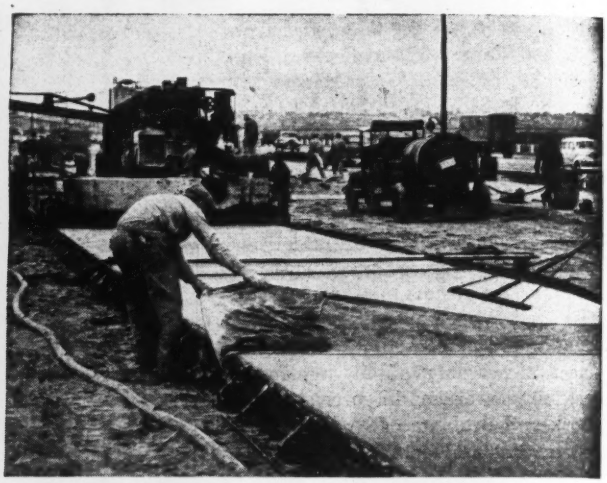
Simple as

No added materials. No unusual changes in procedure. Making concrete that is highly scale-resistant and otherwise better at no extra cost is simply a matter of using Atlas Duraplastic air-entraining cement. For example, on Route 25, New Jersey:

REDUCED SEGREGATION: Duraplastic concrete is more cohesive . . . flattens out without segregation . . . coarse aggregate is well covered with mortar.



IMPROVED PLASTICITY of Duraplastic concrete is illustrated by appearance and over-all texture of surface after first screeding.



MINIMIZED BLEEDING is characteristic of Duraplastic concrete. Finishers may follow closely behind paver. This reduces long waits and overtime at end of day's run and permits early protection for curing.

It's as simple as A, B, C. Duraplastic cement makes better concrete at no extra cost. Send for further information. Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

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ENR-D 48

AIR BUBBLES IN CONCRETE . . . MAKE IT MORE DURABLE . . . AND MORE PLASTIC

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MAKES BETTER CONCRETE AT NO EXTRA COST

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel—Sunday Evenings—ABC Network*

News of the Week

ENGINEERING NEWS-RECORD • APRIL 3, 1947 • VOLUME 138 • NUMBER 14

House roads group favors extension of federal aid

Subcommittee unanimously accepts bill to extend time funds will be available to states for highway projects—Approval by full committee and Congress expected

By a unanimous vote, the roads subcommittee of the House Public Works Committee March 26 approved passage of a bill (H. R. 1874) that would extend the time the large funds provided in the Federal-Aid Highway Act of 1944 would be available to state highway departments. The bill would amend the law so that the $500,000,000 of federal money provided for each of the first three postwar years would continue to be available for two years after each specific year. As the law is now written, the money can only be carried over for one year if not immediately requisitioned by the states.

Approval of the bill by the sub-committee followed one brief hearing, with the bill being reported out favorably immediately afterward. Not a single witness testified against the measure. Speedy action by the entire House committee is expected and early approval by the entire House of Representatives is anticipated. No similar bill is before the Senate, but such a proposal is expected to be introduced in the upper house soon.

Work retarded

During the brief hearing Commissioner Thomas H. MacDonald of the Public Roads Administration revealed that many factors were retarding highway construction. Of the $975,000,000 of federal-aid available March 1, about 69 percent was covered by approved programs but only 35 percent has been covered by actual plans. On the same date, $400,000,000 of road construction involving about $200,000,000 of federal-aid was in progress, while some $74,000,000 of contracts involving over $37,000,000 of federal funds had been awarded but not placed under construction, he said.

In addition to the shortages of materials and equipment and the scarcity of labor, the lack of roadbuilding contractors was cited for the slow start of the postwar program. Commissioner MacDonald explained that before the war about 5,600 contractors were engaged on federal-aid highway work but during the last two years about 2,500 less firms have been engaged in this type of building. The breaking up of large jobs into several small projects has encouraged more contractors to participate in the road program and has aided in getting lower bids, Mr. MacDonald stated. However, he said that there was still a great need for more contractors.

When queried on highway construction costs, the PRA commissioner said that present-day costs are 66 percent higher than in 1940. Because of higher bids, over 20 percent of all bids received last year for federal-aid road jobs were rejected.

However, Mr. MacDonald stressed that his department expects roadbuilding costs to continue above prewar levels for some time and that improvement of the country's highways cannot be delayed until prices drop to what they were before the war. He revealed that about 27,000 miles of the federal-aid highway system can no longer be maintained economically and instead must be rebuilt. In addition, traffic accidents were reported as increasing daily and are expected to get worse rapidly with the greate increase in automobile registrations, which now total between 32,000,000 and 33,000,000 vehicles, unless much construction is carried out.

MacDonald's belief that the greatly needed road construction program could not be withheld any longer met the approval of several other witnesses, which included representatives of the American Association of State Highway Officials and the American Road Builders' Association.

Wide World photo

"Biggest Inch"—*Said to be the largest and longest gas pipe line ever built is the 1,200-mi., 30-in. dia. pipeline now being put down across California deserts and farmlands, from Texas oil fields to Los Angeles. Welding crews assemble 60-ft. sections before the pipe is put into its trench, near Indio, Calif. Contractor on this section is the H. C. Price Const. Co. The pipe was fabricated by the Consolidated Steel Corp., Los Angeles.*

To let grading contract for Baltimore airport

Plans and specifications for the grading contract for the new Baltimore Municipal Airport at Friendship Church in Anne Arundel County, Maryland, 4½ miles south of the Baltimore city line, are nearing completion and probably will be advertised for bids during this month. The contract will call for clearing and grubbing the area, handling about 6,000,000 cu. yds. of unclassified excavation, and the laying of about 10,700 lin. ft. of concrete pipe.

Requests for additional information required by prospective bidders on the project may be sent to Whitman, Requardt-Greiner Co. and Associates, 1304 St. Paul Street, Baltimore 2, Md.

The executive director of the Baltimore City Aviation Commission is Cecil R. Moore, who was formerly chief engineer of the Army Service Forces, European Theater of Operations, and who retired several months ago as a major general.

NEWS IN BRIEF

In telegraphic form, here are late news developments on the engineering and construction front during the week.

Construction—Award has been made in the amount of $6,618,262 to the Arundel Corp., Baltimore, Md., and the L. E. Dixon Co., San Gabriel, Calif., to build the Narrows Dam and power plant on the Little Missouri River, *Pike County, Ark.* . . . A law just passed in Indiana enables Allen County to hire an architect to design and supervise a war memorial coliseum at *Fort Wayne* for which $2,500,000 of bonds will be issued. . . .Consoer, Townsend & Associates of Chicago have been retained to carry out the $100,000 improvement program at the Bryan-Defiance airport, *Defiance, Ohio.* . . . Magnavox Co., Ft. Wayne, Ind., will construct a million-dollar factory of concrete block and steel at *Paducah, Ky.* It will have 100,000 sq. ft. of floor space. . . . Grading work is under way for the new $1,700,000 Corning Glass plant at *Muskogee, Okla.*, the main building to have 130,000 sq. ft. of floor space. . . . On May 13 bids will be opened for construction at the Oregon State College, *Corvallis*, estimated to cost $2,200,000. . . . Plans for a $20,000,000 expansion program of the Carborundum Co. at Niagara Falls, N. Y., were revealed in the company's annual report. A new research center is included in about 20 projects now under construction. . . . Spencer Chemical Co., *Pittsburgh* and *Crestline, Kan.*, is planning a $2,000,000 expansion program. . . . Owens-Corning Fiberglas Corp. has bought 42 acres at *San Jose, Calif.*, to build a plant expected to cost $7,000,000. . . .Construction on the $22,000,000 Tenkiller Ferry Dam on the Illinois River 13 miles above its junction with the Arkansas is scheduled to start in 1947, according to the Army district engineer's office, *Tulsa, Okla.*

Housing—George Wallace Realty Corp. has plans for 70 homes in *Tonawanda, N. Y.*, to cost about $500,000. . . A $3,000,000 apartment subdivision is planned on 39 acres at *Louisville, Ky.*, according to LeRoy Highbaugh, who is an official of the American Building and Loan Association. . . .Carrying out long-considered plans for slum clearance at *Halifax, N. S.*, and *St. John, N. B.*, has been recommended by municipal officials to increase employment and provide much needed housing. . . . A new county planning commission authorized in *Indiana* will specify under what conditions new additions to cities and towns are to be plotted and approved.

Water supply and sewers—A referendum will be held soon on a proposed $300,000 bond issue for a sewage disposal plant for *Round Lake, Ill.* . . . Three economic and engineering reports are being prepared on a proposed $2,500,000 sewer project to serve 5,500 homes in *Salt Lake County, Utah.* . . . *Flint, Mich.*, has opened bids on one phase of its $5,350,000 water plant expansion program designed to increase the supply by over 7 mgd. . . . *Largo, Ind.*, is to vote on a $150,000 water and sewage system. . . .

Midwest states outline highway plans

Extensive highway programs now being prepared in ten middle-western states were reported in detail recently to members of the Mississippi Valley Conference of State Highway Officials, meeting at Chicago, Ill. The reports (*ENR* March 27, vol. p. 476) included some accounts of work placed under contract in 1946.

Depending on improving economic conditions, Wisconsin plans on placing under contract this year, $16,000,000 of construction on the state trunk highway system, $3,000,000 worth of work off the system but administered by the highway commission, and $1,330,000 of urban highway construction. Some $4,800,000 worth of highway construction, carried over from last year, also will be completed this year.

Construction programmed for 1947 on Minnesota highway system includes: 312 mi. of grading estimated to cost $8,896,000; 100 mi. of paving at $5,000,000; 20 mi. of stabilized gravel base and bituminous surfacing, to cost $2,100,000; widening and resurfacing 71 mi. of concrete pavement at $1,537,000; and 36 bridges to cost $2,881,000. In addition, some $6,000,000 worth of work is planned this year on the secondary highway system involving 60 mi. of grading, 250 mi. of gravel base and bituminous surfacing and 30 mi. of dry gravel surfacing.

South Dakota carried over $4,786,000 of uncompleted highway construction from 1946. Their 1947 program calls for 135 mi. of bituminous surfacing estimated to cost $1,145,000; 164 mi. of bituminous treated base course with seal, to cost $1,960,000; 104 mi. of gravel surfacing at $187,000; 93 mi. of grading at $990,000; 13 major bridges at $383,000 and 1 large grade crossing estimated to cost $250,000.

North Dakota expects to let contracts this year for some $6,000,000 of highway construction. Missouri expects to put $17,000,000 worth of work under contract, and Kansas expects to let contracts for some $20,000,000 of highway construction this year. Kansas also reported that of its $8,661,000 maintenance budget for this year, some $2,300,000 will be spent for resurfacing.

Mississippi's 1947 highway construction program includes 300 mi. of grading, drainage and bridges to cost about $12,000,000; 252 mi. of hard surfacing of all types to cost $2,600,000 and $710,000 for railroad grade separations. Kentucky plans to "black-top" about 350 mi. of its traffic-bound highway surfaces this year. In addition, considerable work will be done on widening and stabilizing road shoulders and the cleaning of drainage ditches.

Iowa to let contracts

Iowa expects to let contracts for 1,400 mi. of grading this year; 1,050 mi. of gravel surfacing; 125 mi. of paving and 100 mi. of stabilized base and bituminous surfacing. Nebraska reported considerable interest is being shown in state legislative circles for increasing the counties' income for graveling local roads, particularly mail routes. No consideration is being given, however, to diverting state highway funds to this plan.

Maintenance costs per mile of highway in Illinois during 1946 were reported higher than in 1945 or in any prewar year. While in a large measure this increase in cost was caused by increased costs of labor, material and equipment repairs, the ever increasing demand of the motorists for better service has had a marked effect toward increasing maintenance costs in that state.

Twenty-eight county road projects

Indiana soon will take bids on 28 county road construction projects—the first such work to be done in that state under the secondary highway provision of the Highway Act. In Michigan, all state highway contracts awarded since last October have contained escalator clauses covering freight rates, base prices of steel, and labor rates. Bridge construction in Michigan has been advanced an estimated six to nine months through a policy adopted last February by which the state buys H-beam piling and other structural bridge steel, with erection being done by contract. Guaranteed delivery dates of June and July, 1947, were secured by the state on structural steel ordered last fall, officials reported.

Survey indicates home building slows as buyers resist continuing cost rise

Excepting in southeast, builders reported cutting 1947 construction program as "buyers' market" becomes general

The long-predicted "buyers' market" in consumer goods has definitely arrived in the home-building sector of the construction industry, and its immediate effect has been a gradual, but very noticeable, decline in plans being made for purchase of dwelling units as prices continue to skyrocket.

A 22-city survey conducted by *Engineering News-Record's* editors and its staff of news correspondents last week revealed a peculiar situation where potential demand remained constant at a high level in most areas of the United States, but where builders were becoming increasingly aware that the buying public is refusing to accept "anything" in the way of a home at "any" price. In city after city the reports indicated that prices of older houses are falling, and builders of new homes are finding their product remains on the market for an appreciable length of time.

Builders everywhere were warning that the industry is pricing itself out of its market, and many builders said they hesitated to start any new work until the situation stabilizes. No one offered any prediction as to when such stabilization might occur, however. It was pointed out that in many areas skilled construction workers earn more than do most prospective home buyers.

Not surprisingly, everyone concerned —except the buyer—blamed everyone else for the situation. Builders inveighed against labor's demands for more and more wages, against low productivity of labor and against materials prices. Real estate men charged increasingly shoddy construction as builders attempt to hold down prices; banks were blamed for increasing stricture on loans to purchasers; labor organizations blamed high material costs and charged contractors with inefficient management.

Spotty picture

The *ENR* survey—based on spot checks in 22 major cities, including New York City, N. Y.; Boston, Mass.; Washington, D. C.; Atlanta, Ga., Memphis, Tenn.; Miami, Fla.; Austin, Tex.; Detroit, Mich.; Chicago, Ill.; Cleveland, Ohio; Kansas City and St. Louis, Mo.; San Francisco, Calif., and Seattle, Wash. —revealed a picture of construction activity that seemed to be regional.

Generally speaking, the northern half of the country showed up as worst in home construction, while areas in the southeast—particularly Miami, Fla., and Atlanta, Ga.—gave no evidence of slackening of construction planned or under way. Some of this is attributable to the slow advance of the construction season in the northern sector, but the northern reports were further darkened by indications that demand is comparatively low.

In the New York area, for example, the Long Island Home Builders Institute reported its members revising their 1947 building schedules sharply downward in view of increasing demands for more pay and buyer resistance, and cited figures to show a drop in home construction during the first two months of the year over 1946 and approximately 65 percent. Seattle, Wash., reported the value of building permits for new housing had dropped by almost half in comparison to 1946. San Francisco, Calif., builders, while reporting that activity was "about on the level of last year", said they were planning on a cut of about 40 percent in building for the full year. One exception in San Francisco, incidentally, was Kaiser Community Homes, which reported all its pre-fabricated homes being sold before actual completion.

Chicago, Ill., builders reported that the number of starts on new residential construction this spring will be "considerably less" than a year ago. Number of starts for February declined 32 percent over last year; and in the same period, building permits dropped about 38 percent. Costs of materials and labor are principal factors, builders said, pointing out that estimated average cost per room for housing starts in the Chicago area have increased 23 percent in the past nine months—from $1,529 in April, 1946, to $1,880 in January, 1947.

Builders at St. Louis, Mo., Austin, Tex.—where building activity was rated at 50 percent of 1946—Indianapolis, Ind., Buffalo, N. Y., Minneapolis, Minn., Little Rock, Ark., Oklahoma City, Okla.; Kansas City, Mo.; Cleveland, Ohio; Boston, Mass.; Houston, Texas, Detroit, Mich., and other cities also reported drops in construction under way or planned.

Southeast is contrast

In contrast, Miami, Fla., Atlanta, Ga., and other southeastern sectors were apparently in the midst of a housing boom. In Miami, for example, nearly 5,000 houses are planned for 1947, and some 73,000 for surrounding Dade, Palm and Broward counties are planned for the near future. In Atlanta alone, some 8,000 units are planned, and for the whole of Georgia, some 40,000.

In the country as a whole, the Office of the Housing Expediter at Washington released figures recently indicating that during the month of January a total of 59,300 units—including some 42,000 permanent dwellings—were completed, for a gain over the previous month, and added that the completion total for February would be about 41,200. When most of the units were started was not specified, but the office said that in January a total of 60,366 construction permits were approved for the entire U. S.

Two more companies get prefab contracts

Housing Expediter Frank R. Creedon has requested the Reconstruction Finance Corporation to negotiate a guaranteed market contract with Pemberton Lumber & Millwork Corp. of Brooklyn, N. Y., for the production in 1947 of 6,000 prefabricated wooden homes.

When negotiated, this will be the twelfth market guarantee entered into under the Veterans Emergency Housing Program and will bring up to 90,200 the number of prefabricated homes to be produced this year under the contracts. In addition, two market guarantee contracts have been issued for the production of new-type flooring.

Mr. Creedon has also requested RFC to negotiate a contract with Fox Metal Products Corp., Denver, for the production of the 1550 aluminum houses.

Cascade tunnel fails of approval by solons

Proposed construction of a high-level tunnel through the Cascade Mountains in Washington state has failed to win the approval of the state legislature, principally because most legislators thought it best to defer construction until a time when it might be needed to provide jobs, according to W. D. Shannon, an engineer who is a member of the state House of Representatives.

The measure was approved by the House, after Ole Singstad, consulting engineer retained to study the project, had made his recommendations (*ENR* Feb. 20, vol. p. 255). It died in the senate during the closing days of the session, however.

Chances that the next session of the legislature, in 1949, will approve the project are believed good.

New York favors turning over airports to port authority for rehabilitation

Bi-state organization will rebuild and operate city's major terminals under 50-year lease—City to get equal share of revenues

Ending more than 15 months of controversy over operation, construction and rehabilitation of New York City's huge airports, the city's Board of Estimate late last week gave preliminary approval to a new offer by the bi-state Port of New York Authority.

Under the new agreement, the Port Authority will be granted a 50-year lease for operation of LaGuardia Field, Idlewild airport (now under construction) and Floyd Bennett Field, recently taken over by the city after operation as a naval airbase during the war. Financially, the city benefits to the extent of 50 percent of annual net revenues, and 75 percent when net revenues equal 5 percent of the interest and amortization charges on outstanding bonds. Additionally, the city is guaranteed an annual minimum payment of $350,000 until 1957, and $450,000 for the remainder of the lease.

Second proposal

The approved agreement was the second proposal submitted by the authority for city consideration. The first, offered late in December (*ENR* Jan. 2, vol. p. 10) provided for a 90-year lease, to be financed with the authority's own bonds at a cost of $191,000,000, and that the city would continue its expenditures for access and facilities at the field. Rehabilitation of LaGuardia Field, whose runways are slowly sinking into the mud of the East River, was also included in the original offer.

City officials immediately balked at the authority's terms, particularly over the long lease, the fact that by law the authority is not subject to suit, and asked that the city be given the right to inspect authority books. Two counter-proposals, both calling for city operation of the fields with considerably less expenditure than that planned by the authority, were submitted to Mayor William O'Dwyer for consideration.

Authority operation of the fields, and the obligation to complete construction and rehabilitation, lift a huge expenditure burden from a city administration already hard-pressed to find money for a 1947 city budget calling for nearly $1,000,000,000.

The city's insistence that it be permitted to recapture the fields should it become dissatisfied with authority operation was turned down on the ground that such a provision would weaken the base for the authority's bonds, but in a compromise, the interstate agency agreed to withdraw its requirement that it be permitted to cancel its lease if the investment to complete Idlewild into a seven-runway stage and rebuild LaGuardia is unprofitable.

Although the authority is exempt from suit, Howard S. Cullman, chairman, has agreed to give the city the right to sue for specific performance of contract, and for rent and damages. The authority agreed to sponsor legislation next year to assure such rights, and will grant the city some supervisory control over construction and operation.

Other provisions include:

The authority agrees to provide its own police and fire protection, and snow and garbage removal service; will provide for housing New York police aircraft, and agrees to protect the city against claims of airlines based on existing leases for the two big fields.

Additionally, the agency will assume $3,500,000 in work contracted for by the city and under way this year, and agrees to spend not less than $100,000,000 within seven years from the date of execution of the lease agreement. This latter sum is exclusive of another $66,550,000 planned for hangars which will be financed by long-term agreements with airlines.

Tolls authorized on Westchester parkways

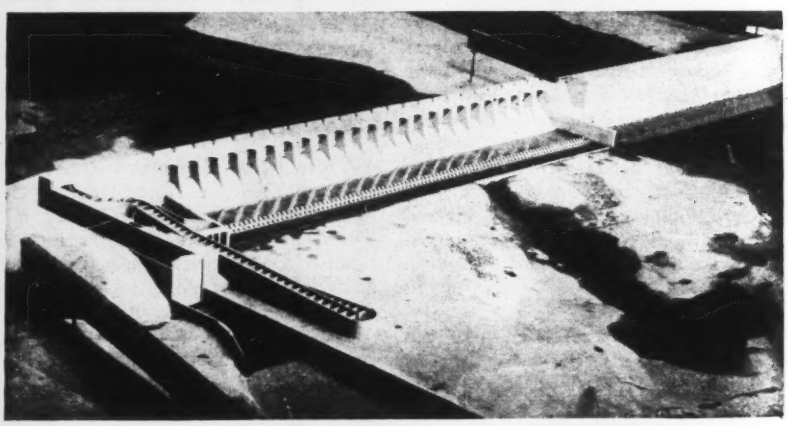
On June 1, Westchester County, N. Y., will put into operation the collection of 10-cent tolls on the Hutchinson River and Saw Mill River parkways and discontinue tolls on the Cross County Parkway, following the enactment of permissive legislation by the state Assembly and signature by the governor.

It is expected that the new tolls will bring in an annual revenue of $1,650,000, but Westchester County must reimburse the federal government for $2,150,233 previously spent to improve the parkways as toll-free roads.

Iowa creates council for state building code

Under a law enacted by the Iowa legislature, the governor is directed to appoint a state building code council, whose first duty it will be to prepare a modern and uniform state building code and codify state building laws.

The council will appoint a technical secretary. An ex-officio advisory committee will consist of the state architect, state fire marshal, director of public health engineering, the state board of education, the superintendent of public instruction, the attorney general and the commissioner of labor. Cooperating are the Iowa Engineering Society and the State Building Code Central Committee representing 34 different organizations having to do with engineering, construction, health, labor, banking, insurance and other interests.



***McNary Dam**—Work is expected to start this spring on McNary Dam on the Columbia River near Umatilla, Ore. Model shows downstream face of the structure with fish-ladder and navigation lock at left of picture. Dam will be of concrete gravity type, with 1,488-ft. spillway; a 20-turbine powerhouse (with an initial installation of twelve 69,000 kw. turbines); and a navigation lock 86 ft. deep and 500 ft. long. Atop the dam structure will be a 30-ft. roadway, and 5-ft. sidewalks for pedestrian traffic.*

Call for tighter Congressional control of TVA construction, auditing methods

General Accounting Office audit rejects theory that agency's power operations are yardstick for private utilities

More stringent Congressional control over all construction projects of the Tennessee Valley Authority, and full repayment of the federal government's investment in the authority's power-producing facilities are called for in the first report of the General Accounting Office on the TVA, submitted to Congress last week.

Made under a congressional directive of two years ago, the audit report covers TVA's operations for the fiscal year ended June 30, 1945, and contains recommendations for drastic revision of TVA bookkeeping.

The report rejects the theory that TVA power operations provide a yardstick for comparison with activities of privately-owned utilities. The pro-rating of the federal investment in multiple-purpose projects among power, flood control and navigation costs results, GAO said, in "reducing operating costs of each activity below what would have been borne on the basis of single-use operations. For this and other reasons, the cost of power operations may not be compared with those of a private power corporation."

Net income from power operations, according to the audit, does not include a number of items which a private corporation must carry. No depreciation is provided, for example, for the costs of land rights and clearing for transmission lines and reservoirs or for relocation and removal of former occupants. TVA also "contributes to the support" of local governments, but makes no contribution to the federal government in income taxes.

Control sought

GAO's principal recommendation calls for establishment of a plan to "provide definitely for the return to the government of its capital investment in TVA power operations, with interest. A needed preliminary to this objective would be the outright repeal of Section 26 of the TVA act of 1933, which provides for repayments to the Treasury from power revenues after deductions, necessary to conduct the agency's commercial power and fertilizer operations."

TVA directors, the report said, have interpreted this provision to authorize the use of power and other revenues for capital purposes other than the construction and acquisition of transmission lines—for the construction of generating facilities and any other facilities required for the electric power business.

This interpretation, it was concluded, has been disclosed to Congress in numerous instances, but construction of additional power facilities without specific appropriations has "operated to limit congressional control."

In the event Section 26 is repealed, GAO recommended an 11-point plan which would reserve to Congress the complete and effective control over TVA programs; provide for repayment of the government's investment in power and yet leave TVA "all necessary flexibility for authorized business operations."

In a move to simplify general accounting, GAO recommended that the authority be permitted to combine under one depository account all of its funds from whatever source derived, and that the requirement that the authority render accounts to GAO be repealed—although this latter move would not affect GAO's annual check of TVA's expenditures.

To finish topographical survey of Indiana

The completion of a topographical survey of Indiana will be speeded up since passage in the General Assembly of a bill authorizing expenditure of $50,000 for this purpose. The preparation of topographical maps and study of the state's water resources have been going forward under a $25,000 annual state appropriation, matched by federal funds and by an additional appropriation of $48,000 last year by the State Highway Department, Conservation Department, State Board of Health, Purdue University, and several interested cities.

Currently Indiana is only 30 per cent surveyed, as compared with 100 per cent in Ohio, 85 per cent in Illinois, 69 per cent in Kentucky, and only slightly more in Michigan and Wisconsin.

Increased use of water in Indiana by industrial interests and greater water use by farmers has brought the water problem to the fore. The topographical maps will be of the greatest importance to the planning of highways, electrical transmission lines, airports and industrial plants.

Construction labor activity continues

New York governor signs bill outlawing strikes by public employees — Painters threaten to strike at Cleveland, Ohio

Action to clarify relations among governmental agencies, private employers and labor held the spotlight in general labor developments last week.

Governor Thomas E. Dewey of New York late in the week signed the Condon-Wadlin Bill (*ENR* March 13, vol. p. 407) to outlaw strikes by public employees. The bill provides that any public employee who strikes shall be dismissed immediately, and, if re-hired at the direction of his superior, may not participate in any pay raises for three years. The bill was opposed by labor, which claimed "harshness" would destroy morale of public employees.

In Westchester County, N. Y., seven employers groups meeting at White Plains announced formation of the Westchester Building Construction Employers' Council, with the objective of adopting a uniform policy in negotiations with building trades unions now seeking further wage increases.

At Phoenix, Ariz., the mayor's office announced appointment of a 19-member tripartite committee to act in labor matters involving the city and its employees, and at the same time, tentative steps were taken toward establishment of a similar committee to handle individual employer-labor disputes.

Agreements on raises for construction workers were reported in many regions. Included were the states of Washington and Idaho, where operating engineers and teamsters were granted an average wage increase of 15 cents per hour; Macon, Ga., where plasters and finishers got 37½ cents and 50 cents per hour increases, respectively; Springfield, Ill., where carpenters agreed to accept a 12½-cent-an-hour increase, and at Spokane, Wash., where all trades were granted 20 cents-per-hour increase, plus time and one-half for all overtime excepting Sundays and holidays, when double-time will be paid.

Strike threatened

At Cleveland, Ohio, the AFL Painters District Council announced plans for a city-wide strike against the Association of Painting Contractors for April 7, in an attempt to enforce demands for a general $2.02½-cent-per-hour wage.

In Philadelphia, Pa., construction worker unions, eyeing the expiration of most of their contracts during April and May, revealed they would ask increases in hourly wage rates ranging up to a top of 25 cents per hour.

Random Lines *from an editor's notebook . . .*

. . . In which ENR's editor makes some timely comments on the progress of plans for improvements to the Panama Canal and tells something of the current work in the Canal Zone

No area of U. S. territory portrays the change from war to peace more strongly than the Panama Canal Zone. Only months ago an armed camp bristling with guns, weighted down with ammunition caches, crowded with troops and continually conscious of air and naval patrols, the Zone is now as outwardly peaceful as Rhode Island. And like any area in the U. S., whose normal and necessary development was arrested by the war, it is busily engaged in catching up on its deferred facilities as fast as available money will permit.

At the same time, the Canal Zone is anxiously scanning the future, since the current Congress-ordered investigation into the adequacy and security of the Panama Canal may radically alter its way of life. The term "security" conjures up the consequences of the atomic bomb and, in turn, such possible measures as building a new canal in another location, major revamping of the locks of the present canal, or eliminating the locks entirely to create a sea-level canal. Under way for more than a year, the investigation is now rapidly heading toward a recommendation, which the Governor of the Canal Zone will first transmit to the Army and Navy for review and comment, and then report to Congress before the end of the year.

In view of this state of affairs, recent stories in newspapers and magazines to the effect that there is an Army-Navy controversy over the type of the canal are obviously untrue. Since the investigators have yet to announce a decision, either to the Army or Navy, differences of opinion can hardly exist.

What seems likely is that the newspapers and magazines have unknowingly bitten off a piece of propaganda. The so-called "Navy" view, favoring an improved lock canal, is actually only the personal opinion of a single Navy captain who, since he is the liaison officer between the investigation and the Navy Department, would seem to be presumptuous, if not unethical, in advancing it before the report is officially rendered. There is no "Army" view, and the only possible material from which to fabricate one is that the investigation is headed by an Army Engineer and much attention has been given to the possibilities of a sea-level canal. But the large investigating staff is entirely civilian, while the powerful board of consulting engineers consists of four civilians, a retired Army Engineer and the Chief of the Navy's Bureau of Yards and Docks. No doubt there will be controversy between lock canal and sea-level advocates, but at present it does not exist between the Army and Navy, and there is no basis for assuming that it ever will exist.

Aids for highway traffic

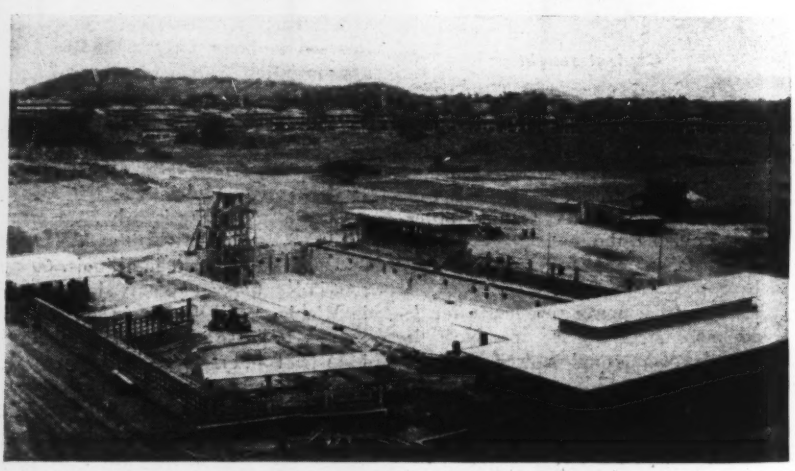
In the meantime, although the canal studies constantly occupy their thoughts, Canal Zone officials turn their hands to building tasks. Currently most of the activity is concentrated on the Pacific side in or near the headquarters communities of Ancon and Balboa. One of the most apparent is a street widening program being carried out by the zone's municipal department. How the narrow, winding streets could have been tolerated during the war is surprising, if half the stories of military convoys being tied up or lost for hours are true. As a matter of fact, the mere widening of some of the narrowest streets is only a beginning. What is needed, in addition, is a major program of grade separations to eliminate bottlenecks whose existence is uneconomic and accident-producing in peacetime and almost criminal in a vital military area in wartime.

The greatest volume of construction at the present time—and scheduled for the immediate future—is in the hands of the Army District Engineer, Col. M. D. Weinert. The Canal Zone has been an Army Engineer district only since July 1, 1946, when real estate and construction operations in such overseas areas as Panama, Hawaii and the Philippines were taken away from the theater commanders and put under the Chief of Engineers. The Panama District reports to the South Atlantic Division, with headquarters in Atlanta, Ga.

Not only is Army Engineer-supervised construction active right now, but additional large jobs are coming up. Colonel Weinert, therefore, is anxious that more U. S. contractors go to Panama. As an example of jobs that the division office at Atlanta will soon advertise may be mentioned the placing of the Corunda River in 7,000 ft. of 10x20-ft. concrete conduit on piles; to cost about 3 billion dollars, this will afford flood protection to Albrook Field. In addition, housing projects for Albrook Field and Fort Clayton will cost $1,150,000 each, while a 140,000-sq. ft. warehouse and sales store to cost about $1 million is scheduled for Corozal.

More contractors wanted

That Colonel Weinert is genuinely concerned with attracting contractors to the Canal Zone and making it easier for them to stay there is evidenced by a recent innovation he has made in their behalf. This is to lease them land on which they can establish headquarters offices, warehouses and shops for as long a time as they wish. Heretofore, as soon as a contractor finished a job for the government he had to move out of the zone, either into the Republic of Panama or back to the United States, since all land in the zone is government-owned. Under the new plan, contractors have a place to



One of the five "Olympic"-type swimming pools being built in the Canal Zone. Pool and all structures are of reinforced concrete. The pool is tile-lined.

hang their hats between jobs, and several have already done so, including McDonald Construction Co., Isthmian Contractors, Tucker-McClure and the Tropical Paint Co.

Principal Army Engineer jobs now under way include a group of five swimming pools and a housing project. Both involve items of interest. The swimming pools are of so-called "Olympic" type, corresponding in every particular to the standards necessary for international competition. Of concrete lined construction with tile lining in which the racing lines are marked, these pools are surrounded by such appurtenances as covered spectator stands, high diving platforms, a children's wading pool and refreshment facilities. Costing $200,000 each, the installations, located at the several military posts in the zone, are financed with profits from the post exchange stores.

New type housing

The housing project, adjacent to Albrook Field, is being built for civilian employees of the Canal Zone, and represents the first instance (other than some temporary war housing) in which such personnel has been accorded new facilities instead of hand-me-downs. Also it is the first housing in the zone in which living quarters are put on the ground floor instead of being raised on stilts.

Such breaking of tradition has not been accomplished without some head-shaking and eyebrow-raising, despite the fact that the practice is common with Panamanian houses. Tradition is very strong in the zone, even to the medical department banning all outdoor dancing at the military clubs in memory of the yellow fever mosquito, which, if he still exists, would probably bite people at work as well as at play.

In any event, the tradition against ground floor housing having been broken, every effort is being made to assure its success. The site, which required 200,000 yd. of material to be moved, involves considerable high fill, which is rolled in 6-in. layers to 87 percent average compaction, with 95 percent in the top 12 in., directly under the houses. Designed for 18 percent optimum moisture content, some of the fill has gone in with as high as 35 percent moisture, necessitating considerable blade-glading and rolling.

All drainage on the site, which is a series of terraces, some as much as 20 ft. high, is away from the slopes. These slopes are compacted by tractors, and immediately planted with sod. In some cases, concrete-lined ditches run diagonally down the slopes to intercept the surface water before its velocity becomes great enough to do damage.

The floor slabs are poured on asphalt paper laid directly on the grade, which is raised 12 in. above the surrounding surface to assist drainage and dryness. An integral waterproofing is also used in the mix. The buildings themselves, which include 35 two-family houses and 10 eight-person bachelor apartments, are also of reinforced concrete, and two stories high, with flat slab roofs. The contractor is the McDonald Construction Co. of St. Louis.

One other construction job is of consequence and, although it is in Panama and not in the zone, it is an American operation. This is the new Panama National Airport, located about 17 miles east of Panama City, which is being built by the U. S. Public Roads Administration acting as the construction contractor.

The PRA accumulated a large amount of big modern construction equipment for building the Trans-Isthmian Highway during the war, and apparently learned how to use it effectively, for it laid down 7,000 ft. of 200-ft. wide runway slab 10½-in. thick in 27 days. It is now engaged in paving the 12-in. thick aprons. Prior to the paving work, it moved over 3,000,000 yd. of earth, including the placing and compacting of 220,000 yd. of shale subgrade.

On current prospects the Panama Canal Zone may be said to be a reasonably active construction area, while if "Isthmian Canal Studies—1947" result in a recommendation to do something to the present canal to make it secure against modern weapons of warfare, the zone may be the scene of the greatest construction job in history.—*W. G. B.*

"MEET ME AT THE WELL"

The "Old Oaken Bucket" of the American Water Works Association is to be set up in the center of the exhibit hall at this summer's joint meeting of the AWWA and the Water and Sewage Works Manufacturers Association. The joint meeting is scheduled to be held at San Francisco July 21 to 25.

Seeking to establish a slogan for the session, convention sponsors said that the imitation well cover will form a focal point for the meeting, and suggested the use of the slogan "Meet me at the well" in references to the meeting.

De Havilland airport to be enlarged

DeHavilland airport, one of the two major airports serving Toronto, Ont., is to be developed into a major Royal Canadian Air Force base by the Department of National Defense. The airport, adjoining the manufacturing plant of the De Havilland Co. of Canada Ltd., was expanded to a major field for war purposes but its complete development has been hindered by the location of a north-south highway crossing the area.

The government has now started condemnation proceedings for two new strips of roadway, one 1,800 ft. and the other 2,100 ft. long, which will permit the complete relocation of the section of Dufferin Street crossing the area. Present runways are 6,000 ft.

R. G. LeTourneau photo

***Seven-Yard Mixer**—Looking startlingly like a big howitzer, a new 7-yard mobile mixer is now being manufactured, particularly for use on monolithic concrete structures. Self-powered, the mixer is loaded at the open end, then swung upward on its base to prevent spilling in transit. Discharge is made through the open end by reversing the direction of revolution. Its manufacturer says the machine can pour concrete into forms as high as 20 ft.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Sewer system plans occupy municipal officials—Newspaper to hire engineer to investigate Richmond, Va., superhighway plans—Phoenix, Ariz., asks bids on parking garages

Anticipating the start of the construction season and the continued industrial and residential growth of their communities, city officials last week continued to advance plans for construction and rehabilitation of sewer systems.

Tampa, Fla., was preparing to make a new start on a 20-year-old, $6,000,000 sewer improvement program, after city officials terminated a contract with one engineering firm, and approved the employment of another to plan the work.

Reconstruction of the system was first planned at the top of the boom of 1927, but action was deferred when the depression of the 30's set in. Repeated efforts of city administrations finally resulted in the employment of the engineering firm of Robert and Co., of Atlanta, Ga., in 1940. However, no construction work has been undertaken. Recently, acting on recommendation of Mayor Hixon, the city government approved a payment of $33,014 to Robert and Co. for services rendered, and terminated the contract.

Also on the Mayor's recommendation, the city approved employment of Greeley and Hansen, of Chicago, Ill., to take over the work, make a new survey of needs, and prepare plans.

Other action

At Wilmington, Del., city Street and Sewer Department engineers told city councilmen that the cost of a new sewer to extend from Market Street to Bancroft Mill will be about $620,000. The new line, supplementing an existing, but overloaded one, would be insurance against pollution of Brandywine Creek.

Speedway City, Ind., (an Indianapolis suburb) announced it was ready to make final plans for a $300,000 disposal plant, as soon as the Indianapolis City Plan Commission approves. The city must build the plant to comply with an order of the State Stream Pollution Control Board to end contamination of Eagle Creek.

Voters of Woodland and Hanford, Calif., recently approved bond issues totalling $750,000, of which more than half will be used for sewage system improvements. Two other California cities—Fresno and Watsonville—will vote soon on bond issues totalling $3,510,000 for sewage disposal units. The Fresno project would cost $2,000,000, and the Watsonville job about $1,500,000.

J. M. Nagle, public works director for Houston, Tex., said that work on the city's $4,000,000 North Side sanitary sewer extension probably will start in 1948, after city officials had approved payments for employment of consulting engineers to make preliminary studies of the work.

Newspaper hires engineer

The city council of Richmond, Va., took unprecedented action recently when it voted to postpone action on a proposed $25,000,000 express highway through the city until a local newspaper hires a "disinterested" engineer to survey the proposal and publishes a series of articles on his findings.

Construction of the expressway was proposed last August (*ENR* Aug. 8, 1946, vol. p. 151) and has been the center of considerable discussion since that time. In a formal request to the council, Tennant Bryan, publisher of the Richmond *Times-Dispatch* asked councilmen to defer action until his newspaper could hire an engineer to review the plans already made and report on them.

The council's streets committee has already held four public hearings on the proposal, at which opposition to the expressway was preponderant.

Phoenix parking garage

Phoenix, Ariz., last week asked for bids on a 500-car-capacity, 3-story-and-basement garage, in the city's first concrete move to solve its growing traffic problem in downtown areas.

Plans for the structure were drawn for the city's parking committee by the architectural firm of Lescher and Mahoney, and city officials estimate revenues from the structure will amount to about $25,000 per year. The basement, second and third stories, and the roof will be used for parking, while the street floor will be reserved for stores.

While Phoenix attacked its traffic problem directly, other cities also reported action. Cambridge, Mass., installed 400 parking meters; Fort Wayne, Ind., awarded contracts for paving and widening six of its downtown streets; and Montreal, Canada, voted funds to finance engineering surveys as basis for plans for alleviating traffic congestion.

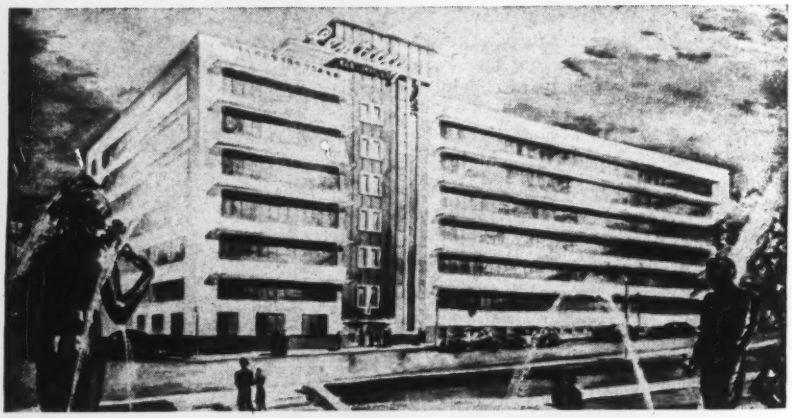
MAJOR MEETINGS

American Society of Civil Engineers, spring meeting, Westward Ho Hotel, Phoenix, Ariz., April 23-25.

National Rivers and Harbors Congress, 37th convention, U. S. Chamber of Commerce Bldg., Washington, D. C., May 2-3.

United States-Mexico Border Public Health Association, annual meeting, San Diego, Calif., May 6-8.

Society for Experimental Stress Analysis, annual meeting, Stevens Hotel, Chicago, Ill., May 15-17.



***Manufacturing Plant**—Construction has started on a $1,000,000 plant for the Century Electric Co. at St. Louis, Mo. Structure will be a 6-story building 75 by 130 ft., plus the addition of five stories to an existing 109 by 180 ft. building and remodelling the older structure to conform. Reinforced concrete, brick and steel will be used. Architects are W. B. Ittner, Inc., and L. B. Pendleton; and general contractor is Thomas J. Sheehan Co., of St. Louis.*

OBITUARY

Ralph Lawrence Gesner, for several years an engineer on the staff of Gen. G. W. Goethals, builder of the Panama canal, died at Ridgewood, N. J., on March 22. During the first world war he served in the Corps of Engineers, and in the last war he was with the War Department in an advisory capacity.

Col. John S. Doyle, 73, of Baltimore, Md., a retired U. S. Army engineer, died in St. Petersburg, Fla., March 11. A civil engineer graduate of Johns Hopkins University, Colonel Doyle had served in the Baltimore district office of the U. S. Engineers for more than 25 years. When he retired in 1944 he was assistant district engineer. After the Baltimore fire of 1904 he was the demolition engineer in charge of blowing up fire-gutted buildings.

William Thornton Rankin, 82, for a long time city engineer of Ottawa, Ont., died there March 21.

David A. Stewart, 73, of Campbellton, N. B., for the last 40 years a general contractor, died March 20, at Campbellton. For ten years, from 1925 to 1935, he had been provincial public works minister for New Brunswick.

John L. Hogan, 64, retired chief engineer for the Triest Construction Co., New York City, died March 27 in White Plains, N. Y. A civil engineer graduate of New York University, 1904, Mr. Hogan was for a time assistant engineer of the N. Y. State Public Service Commission.

John J. Ward, who had been with the Delaware, Lackawanna & Western Railroad for 49 years and was engineer in charge of construction at the Hoboken, N. J., offices when he retired in 1929, died in Newark, N. J., on March 27.

James B. French, Jr., 61, construction engineer, died March 20 at Seattle, Wash. A native of Chicago, he obtained his education at the Lewis and Armour Institute in that city. As president of the J. B. French Co., general contractors of Chicago, he built Northwestern University's Dyke Stadium. He was employed by the U. S. Department of the Interior during the late 1930's as chief engineer of public works field inspections in 13 states. During World War II, Mr. French served as civil and consulting engineer for the Puget Sound Bridge & Dredging Co. of Seattle. He was job manager in charge of construction of the $35,000,000 naval air base at Sitka, Alaska, and later served in an advisory capacity in construction jobs along the Aleutian Island chain.

A. Merton Rich, 64, a structural engineer, died March 23, in Arlington Heights, Mass.

Herbrand Harvey, civil engineer, died in Petersfield, England on Feb. 24. His work in the Americas included jobs in New York City, as superintendent for the Fuller Construction Co. in the construction of the Fourteenth Street Store; superintendent for S. Pearson & Son on the construction of Puerto Mexico at the mouth of the Coatzacoalcos River, Isthmus of Tehuantepec, and The Port of Para, inside the mouth of the Amazon River, Brazil, and superintendent of port works on Guam. Other connections included resident engineer for Chile Exploration Co., Chuguicanafa, Chile; general manager, Anglo-Mex. Oil Refinery, Minatiflan, Mexico; clerk of the works, the Great Loch Aber tunnel, Ft. Williams, Scotland; and manager of the Port of La Guaira, Venezula, and director of the port of Manaus, Brazil. He prepared reports on port works at Fortaleza, Ceara, Brazil; Buenaventura and Barranquilla, Colombia; Valparaiso, Chile; and elsewhere in various parts of the world.

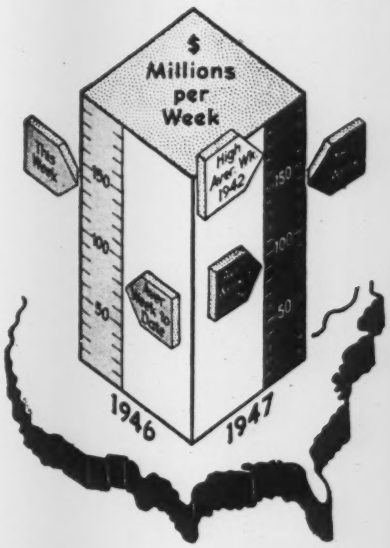
Edward A. Dieterle, 65, consulting engineer, Glen Ellyn, Ill., died March 16. Mr. Dieterle was graduated in 1904 from the department of civil engineering, University of Illinois.

August J. Kramp, 79, president of Kramp Construction Co. of Milwaukee and Berlin, Wis., died March 18. Mr. Kramp's firm constructed many of the state's principal highways and also a large addition to the Milwaukee's sewage treatment plant.

Arthur Middleton Campbell, 83, died at Florence, S. C., March 20. He was designing engineer for 44 years for the Valk & Murdock Co., at Charleston, S. C. At the age of 80 he was recalled by the government to Charleston, E. C., to be a draftsman with the U. S. Army Engineers.

S. Boyd Trescott, 86, timberland surveyor and retired consultant on municipal sewer systems, died in Abington, Pa., March 28. Mr. Trescott, who retired five years ago, had worked on timberland surveys for nine eastern states. This work included a survey of all of the state line between New York and Pennsylvania from the Delaware River to Lake Erie.

CONSTRUCTION ACTIVITY



As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of Apr. 3 1947	Cumulative 1947 (14 wks.)	Cumulative 1946 (14 wks.)
Federal	$20,877	$108,369	$120,900
State & Mun.	50,464	356,317	257,116
Total Public.	$71,341	$464,686	$378,016
Total Private	59,421	853,952	733,260
U. S. Total..	**$130,762**	**$1,318,638**	**$1,111,276**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (14 wks.)	Cumulative 1946 (14 wks.)
Waterworks	$2,185	$29,545	$28,200
Sewerage	1,635	22,010	14,077
Bridges	1,662	36,745	26,827
Highways	24,612	146,689	135,597
Earthwork, Waterways	23,951	52,724	74,461
Buildings, Public	12,779	124,726	72,921
Industrial	24,937	215,716	267,519
Commercial ..	33,429	523,391	425,039
Unclassified	5,572	167,092	66,635

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (14 wks.)	Cumulative 1946 (14 wks.)
NON-FEDERAL	$451,533	$224,886
Corporate Securities.	184,438	93,967
State and Municipal.	267,095	130,919
FEDERAL	.....	158,320
Total Capital.....	**$451,533**	**$383,206**

ENR INDEX NUMBERS

Index Base = 100	1913	1926
Construction Cost Apr. '47	396.09	190.40
Building Cost....Apr. '47	300.81	162.61
Volume .....Mar. '47	220	96

EDITORIALS

VOLUME 138 NUMBER 14

April 3, 1947

Strikes of Public Employees

TWO EVENTS having an important bearing on the difficult problem of preventing strikes among public employees were recorded late in March. New York State passed a law barring strikes among public employees in that state, and in New York City, where in recent years the transit workers frequently have threatened to strike, the mayor set up a new labor policy under which department heads are required to give prompt consideration to the adjustment of day-to-day grievances and to give employees an opportunity to discuss wages and working conditions with them either individually or through representatives. Such a plan, if sincerely followed, should do much to offset any fear on the part of the city's employees that the state's drastic new law has weakened their economic position. If that can be accomplished, a long step forward will have been taken toward solution of a difficult problem. As was pointed out in these pages some months ago (*ENR* Sept. 19, 1946, vol. p. 358) any program designed to prevent strikes among government employees must, if it is to be successful, give those employees a bargaining position equal or superior to that of persons in private employment. They should never have to threaten a strike in order to get a fair hearing of their grievances. In other words, any move to prevent strikes among public employees by setting up severe penalties for striking must be accompanied by regulations that will eliminate or minimize the current sources of such strikes.

Model Code Possibilities

WITH IOWA AND CONNECTICUT moving to establish state building codes, as noted elsewhere in this issue, the trend toward uniformity of regulation is more pronounced than ever. Evidently, the public is becoming increasingly aware of the many advantages of a model code—prevention of jerry-building in areas currently lacking adequate legal safeguards; savings effected through centralized testing and approval of new materials; assistance provided small communities that could not afford to prepare a code; and the numerous benefits accruing from uniformity. The trend toward uniformity could be further encouraged and the cost of code preparation minimized if more code drafting authorities would merely adopt as their model one of the several fine, established codes. A prominent candidate for emulation would be the Uniform Building Code of the Pacific Coast Building Officials Conference already in use in some 500 cities in every part of the country. Since there are many obstacles to hurdle in achieving passage of uniform building laws (three years of intense effort were required in Iowa), the ability to point to satisfactory experience with the same code in neighboring areas at least would not add to these troubles as development of fresh regulations is likely to do.

Toll Roads

THE NEW RASH of toll road proposals that has broken out across the country is a phenomenon that warrants the close attention and study of highway officials. Legislation relating to toll highways has been introduced into six state legislatures, according to a survey made by the National Highway Users Conference, and, in addition, there is the perennial bill in Congress putting forward the grotesque proposal to build six transcontinental toll highways at an estimated cost of $12 billion. As all students of highway development know, there would be no excuse for toll road proposals if all the money collected from highway users in the form of taxes and licenses were applied to road building and repair. Also were it not for the curtailment of roadbuilding during the war years, there would be less willingness now to consider toll roads as a solution of the highway traffic problem. As a matter of fact, they can seldom be considered a solution, for toll roads can be built no more rapidly than free ones, and in only a few places can toll roads be justified on the ground that the state is unable to finance a free road. There would seem to be two steps to take with respect to toll roads: avoid building up a demand for them, wherever possible, by ceasing to divert highway tax money away from highway building; and, when a toll road is undertaken, to insist that all toll collections be applied only to operating costs and debt amortization to the end that tolls are reduced as fast as possible and then removed entirely.

All Forty-eight States

PASSAGE of a registration law for civil engineers and land surveyors in Montana (*ENR* March 27, vol. p. 472) leaves no state without legal rules covering the practice of engineering in some or all of its branches. Only the District of Columbia is

now without a registration law. Thus it may be said that a movement that began about a quarter century ago has come to a successful conclusion. Although many engineers opposed registration when it was first proposed, few now doubt its value. Anticipated abuses have not developed, and the laws have been effective in numerous instances in checking practice by incompetent persons. On the other hand, much yet remains to be done toward strengthening some of the state laws, and there is need for greater uniformity in license requirements among the states. And there always will be the necessity for watchfulness to make certain that these laws are not used to keep men from outside any state from competing with home talent or as a means for restricting the number of men who enter the engineering profession.

Something for Nothing

AN ISSUE OF INTEREST to all professional societies is raised by the cool reception accorded to the current plan to raise the dues of members of the American Society of Civil Engineers. Judged by the reaction to petitions asking the Board of Direction to put the matter of higher dues before the members in the form of an amendment to the society's constitution, the prospects for the proposed increase do not appear bright.

The reason for this is not obvious in the ASCE record. No one could have attended meetings of that society in recent years without gaining a clear impression that, in addition to the society's activities in technical matters, the membership at large wanted it to take leadership in obtaining wider understanding of the part that engineers play in the daily life of every citizen and in fostering greater dependence on engineers for advice on national and international issues. And it appears true also that a large majority of the membership wanted the society to work for better pay for the rank and file of engineers and that a considerably smaller number favored having the society work for establishment of the principle that engineering employees should not be compelled to join collective-bargaining groups in which they have little voice.

There can be no doubt that it was to attain these objectives that successive boards of direction of the ASCE have expanded the society's activities beyond purely scientific fields. Outstanding among these newer activities are the maintenance of a full-time representative in Washington to keep members of Congress and heads of federal departments advised as to the society's position on matters affecting engineers; and establishment of regional offices to facilitate prompt action by the society, especially on economic questions of interest to engineers.

The society has also moved beyond its former field of activity in providing aid to engineering employees in the establishment of independent collective-bargaining groups, and in making studies of pay and employment conditions among engineers in state highway departments and similar public agencies to aid in improving conditions for those engineers. Expansion of the society's facilities for publicizing the work done by the society and its members has been undertaken; and, finally, the society has taken an active part in the Engineers Joint Council and in the international organizations of engineers that are just beginning to take form.

These activities cost money. They could not have been carried on along with the society's technical work had it not been for the fact that the society's membership has been steadily increasing. Now the time has come when that increase no longer offsets the added costs. As a result, the board has asked the members to authorize an increase in dues. If the board erred, it erred on the side of conservatism because there is good reason to expect still further increases in costs of the national and international activities that engineers appear to want.

Thus, the issue now before members of the ASCE is larger than just a $5 increase in dues. And its significance extends far beyond the ASCE, for a similar situation exists in the national and state societies of professional engineers where a few men are attempting to carry on very worthwhile work with financial support from only a handful of the thousands of registered professional engineers.

By their vote on this question of an increase in dues the members of the ASCE will be putting a large segment of the engineering profession on record as to whether it is willing to back with dollars its desire for wider public recognization or whether it seeks something for nothing.

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Fig. 1. Soil-cement base is mixed in a single pass for its full depth on North Carolina secondary road construction.

Secondary Roads Paved With Soil-Cement

***Contents in Brief**—Improvement of a large mileage of secondary roads in North Carolina calls for construction of a 6-in. thick soil-cement base followed by bituminous surface treatment or addition of a top of sand asphalt. A variety of soils is being stabilized and the equipment used includes a new machine that mixes the soil and cement for the full depth of the base in a single passage. Tractor-mounted harrows and sheepsfoot rollers are also being used. Cost of the pavement varies from $0.95 to $1.41 per sq. yd.*

As part of a program placing emphasis on improvement of secondary roads, the North Carolina State Highway and Public Works Commission last year awarded over $1,000,000 of work calling for construction of a soil-cement base followed by a bituminous surface treatment. In all, more than 110 miles or over 1,700,000 sq. yd. of this type of pavement on secondary roads was awarded with about 50 percent of the work to be completed by the end of 1946. Based upon the results obtained in the large 1946 program, plus eight years of previous work under a wide variety of conditions, engineers of the North Carolina department now consider this type of improvement an important part of their construction procedures.

The soil-cement work was restricted to existing unsurfaced secondary roads carrying a maximum of 400 vehicles per day. Generally, a soil-cement base 19 ft. wide was constructed followed by a surface treatment 18 ft. wide. However, on some jobs these measurements were 21 and 20 ft. respectively.

In advertising last year's secondary program, the highway department requested contractors to submit alternate bids for construction of a 6-in. thick soil-cement base with bituminous surface treatment and an equally thick traffic-bound macadam base with a similar surfacing. Most of the bids for the base stabilized with cement were lower than those for the macadam base, some as much as 20 percent. This difference in bids resulted in the awarding of nearly 110 miles of the soil-cement work.

REQUIRED GRADATION OF SAND USED FOR SAND ASPHALT WORK

Passing sieve	Retained sieve	Percent of total by weight
No. 4	No. 10	100
No. 4	No. 40	0 to 10
No. 10	No. 80	10 to 50
No. 40	No. 200	25 to 55
No. 80		10 to 35
No. 200		5 to 10

Note: Maximum permissible clay in aggregate by elutriation is 6 percent.

The difference is explained by the critical shortage of most types of stone in North Carolina at that time, by the experience gained by contractors during the war years on projects requiring bases stabilized with portland cement, and by the development of new equipment designed especially for this type of operation. Some of these factors favoring the soil-cement base may diminish during the next few years with a good percentage of the surfacing projects on the secondary system to consist of the traffic-bound base, as this method is expected to continue an important part in North Carolina operations. However, the experience gained in stabilizing different types of soil with portland cement is expected to result at the same time in considerable mileage of this type of construction.

The amount of cement used in the 1946 program to stabilize a 6-in. base varied from 8 to 12 percent by *volume*, although on a few projects as much as 16 percent was added. The types of soils stabilized varied from heavy clays to sandy loams, including soils of the A2, A4, A5 and A7 classifications of the Public Roads Administration. In general, the A2 type has required the least cement and the A7 the most.

Regardless of the percentage of cement specified it is all added in a single application at an early hour in the day. Most contractors have chosen to use bag cement delivered by truck and spread by hand. In this work, a tape or twine is stretched at the edge of the roadway with markers indicating the required spacing of the bags, the number desired at each point having been determined previously. The bags are opened and the cement spread roughly by hand. A steel-toothed harrow is then used to complete the spreading of the cement.

In contrast to the hand placing of the bags, one contractor chose to use bulk cement delivered with a truck equipped with a special spreader that added the cement in a uniform layer. Considerable difficulty was encountered with the first spreader used and the contractor was attempting to devise a better unit when operations were shut down because of cold weather.

Mixing by two methods

In mixing the cement with the soil, two general methods were followed. Most contractors elected to use the tractor-drawn rotary tillers of the type employed so widely during the war on airbase construction. In using this type of unit, the soil of the base is scarified before application of the cement by means of the scarifying attachment on a motorized grader or a tractor-drawn scarifier. Multiple-bottom gang plows and heavy duty cultivators are employed to assist in the mixing and to bring the bottom material to the surface. Any required water is added with pressure distributors, frequent passages of the truck usually being necessary. The amount of water required to bring the mix up to moisture content varies widely from soil to soil with the desired content at the start of compaction varying from 15 to 30 percent by *weight*.

In contrast to the mixing method just described, two contractors are using a new type 26-ton self-propelled mixer recently placed on the market. This machine scarifies and mixes the material for the full 6-in. depth of the base in a single passage. During the mixing operation the machine also adds sufficient water to bring the water content of the mix up to the optimum. This equipment is shown in operation in Fig. 1.

The new type unit is mounted on crawler tracks and is powered by twin diesel engines with a total capacity of 290 hp. It has four forward speeds and an equal number in reverse, with the maximum about 31 ft. per min. At the rear of the machine there are four chain-driven shafts equipped with scarifying teeth and mixing paddles. The shafts are mounted in a rigid frame that is raised and lowered hydraulically to control the depth of the mixing, a maximum depth of 9½ in. being possible. The first shaft is equipped with teeth designed to scarify the base material, while the blades of the second, which rotate in the opposite direction, are designed to blend the cement and the soil. The desired water is added directly back of this rotor by means of two spray bars designed to add the water to the materials after they are thrown into the air by the second shaft. The remaining two shafts behind the spray bar revolve in opposite directions and are designed to function as pug mills. The machine mixes a width of 8 ft. 2 in.

With both types of mixers, opera-

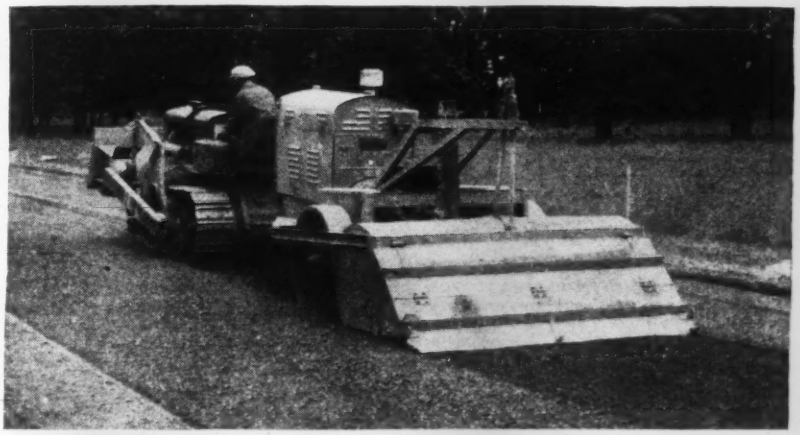


Fig. 2. Instead of using the unit illustrated in Fig. 1, some crews are employing the above type of mixer, which was used on airbase construction during the war.

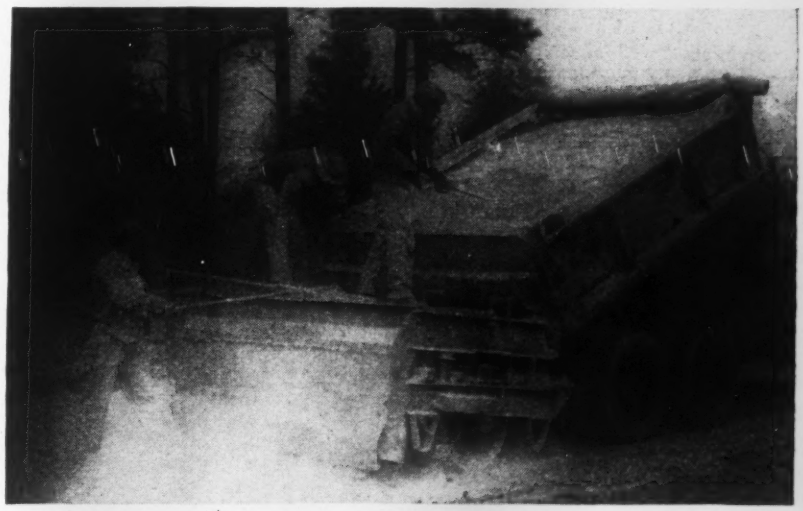


Fig. 3. Rather than spread the cement by hand, one contractor has speeded up this operation appreciably by using a mechanical spreader.

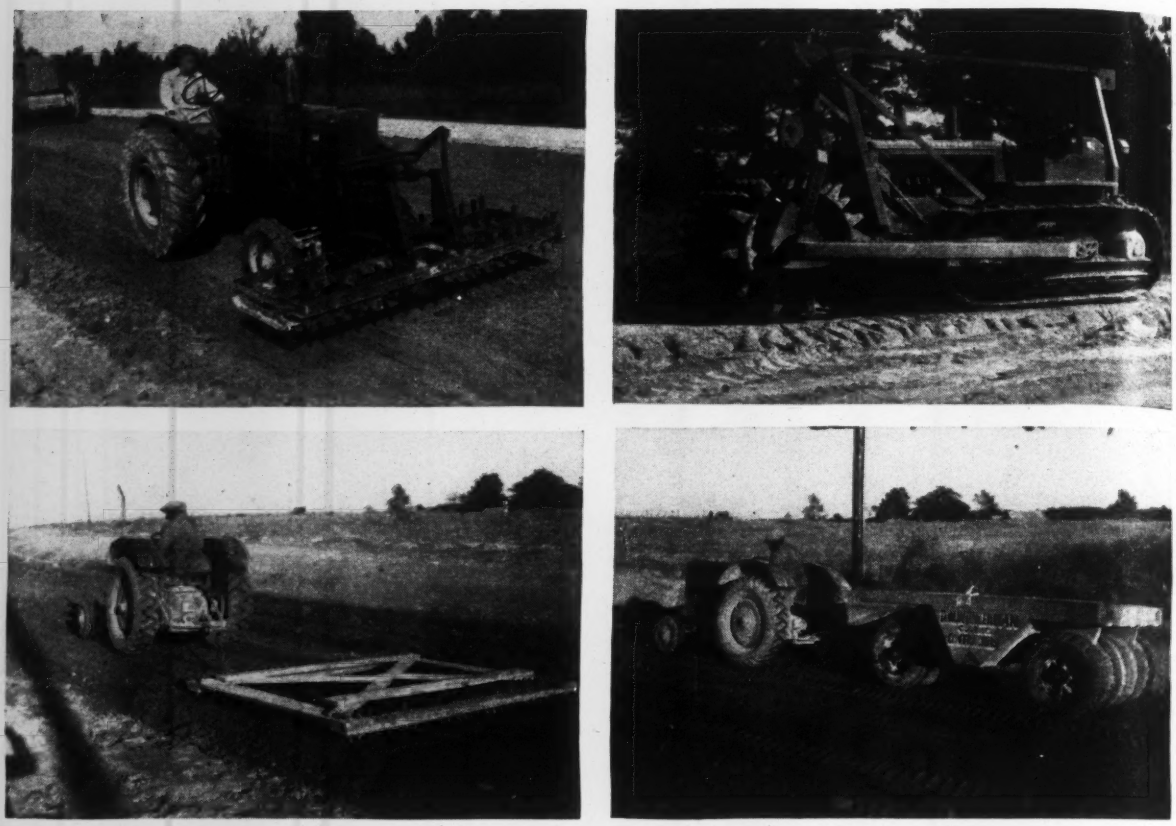


Fig. 4. Equipment employed on the compaction and leveling operations includes tractor-mounted steel-toothed harrows (upper left), tractor-mounted sheepsfoot rollers (upper right), light-weight spike harrows (lower left) and pneumatic-tired rollers (lower right). Other equipment used includes distribution trucks and motorized patrol graders.

tions are usually confined to a section not over 2,500 ft. long and frequently as short as 1,000 ft. In all cases the contractor is required to finish the same day a section once started.

Compaction of the soil-cement after mixing has been much the same on all jobs. Most of the compaction is accomplished with sheepsfoot rollers, but toward the end of this operation pneumatic tired rollers are used. During compaction with the sheepsfoot rollers, motorized patrol graders are employed to shape up the roadway. Also, water continues to be added in light applications with the pressure distributors.

Once the sheepsfoot rollers have compacted all of the base except the surface material, their use is discontinued and a steel-toothed harrow is used to loosen the top one inch, which is then compacted with several passages of the peneumatic-tired roller loaded to give a minimum compression of 325 lb. per inch of width of tire tread. A spike drag is used just before the last few trips of the pneumatic-tired roller to aid in eliminating irregularities in the surface of the base. Immediately after the rollers are taken off, the patrol grader blades off the high points on the base to produce a smooth surface.

To assure proper curing of the soil-cement mixture, the top of the base is kept moist for 72 hours.

Progress in constructing the base has varied widely with the amount of equipment available, the labor supply, and the type of soil stabilized. The daily average for a single crew on good days has been about 3,000 ft. and the top production for the 19-ft. wide base approximately 4,000 ft. in a single day. However, because of the large amount of rain last summer and other interruptions, the weekly progress for a single crew on most of the projects has been only about 1½ miles of processed base.

Base gets surface treatment

To complete the paving operation, the stabilized base is given a bituminous surface treatment with a drag-broom seal, although in a few cases the base has been surfaced with a hot-laid sand asphalt put down with a paver. Where the surface treatment is selected, any loose material on the base is first removed with a rotary broom and a prime of 0.2 to 0.25 gal. per sq. yd. of RT-2 tar applied with a pressure distributor at a temperature of 120 to 130 deg. F. After the prime has cured sufficiently, which usually requires a couple of days, 0.4 gal. per sq. yd. of 150 to 200 penetration asphalt is added with the distributor at a temperature of about 300 deg. Application of the asphalt is followed immediately by the addition of 40 lb. per sq. yd. of stone (Fig. 4). This material must have the following sieve analysis:

Sieve size	*Percent passing*
1½ in.	95 to 100
¾ in.	30 to 50
½ in.	0 to 10
No. 4	0 to 2
No. 200	0 to 0.5

Several types of stone for this work have been used, including river gravel

and crushed granite and dolomite. The stone is added at air temperatures as taken from the stock piles and is rolled immediately with flat-wheel rollers.

After about ten days a seal is added. In this work, 0.2 gal. per sq. yd. of RC-1 or RC-2 asphalt is applied at a temperature of 120 to 130 deg., followed as soon as possible by 20 to 22 lb. per sq. yd. of stone of the following graduation:

Sieve size	*Percent passing*
¾ in.	100
½ in.	95 to 100
⅜ in.	75 to 90
No. 4	25 to 50
No. 16	0 to 4
No. 200	0 to 0.5

Once the stone has dried, another 0.2 gal. of RC-1 or RC-2 asphalt is added and the stone and asphalt are mixed immediately with broom drags mounted on pneumatic tires. After a couple of passes of the drag, smooth steel-wheel rollers of 5 to 7-ton capacity are used to compact the seal and complete the surfacing.

Sand asphalt also used

To determine the best type of surfacing for a base stabilized with portland cement and to take maximum advantage of equipment and materials available, a considerable mileage of the soil-cement base has been surfaced with sand asphalt. A sand considered satisfactory must have the sieve analysis shown in the table on p. 64. To the sand about 8 percent by weight of 85 to 100 penetration asphalt is added. The materials are plant mixed.

A couple of days before this type of surfacing is applied the base is cleaned with a rotary sweeper and an asphalt prime coat of 0.2 gal. per sq. yd. of MC-0 applied at 120 to 130 deg. F. Generally, 100 lb. per sq. yd. of the sand asphalt is used, which results in a thickness of about 1 in. It is put down with a self-propelled paver at a temperature of 275 to 300 deg. (Fig. 5). Rolling with an 8 to 10-ton smooth roller follows, and within a few hours the completed surfacing is opened to traffic.

Contract cost of the 6-in. soil-cement base on the jobs already completed has varied from $0.63 to $1.06 per sq. yd., with the average about $0.75. The surface treatment has cost $0.32 to $0.35 per sq. yd., as has the sand-asphalt work, making the total cost of the pavement $0.95 to $1.41 per sq. yd. Work to date indicates that both types of pavement will be able to carry a volume of traffic if the percentage of heavy trucks is small.

Fig. 5. Bituminous surface treatment for soil-cement base consists of a prime coat, asphalt applied at high temperature and 40 lb. per sq. yd. of stone rolled with flat-wheel rollers. A seal is added later.

The work is being done under the direction of W. Vance Baise, state highway engineer for the North Carolina State Highway and Public Works Commission, and T. V. Fahnestock, bituminous engineer, and L. D. Hicks, testing and soils engineer.

Contractors on the several projects mentioned include: Winkelman Construction Co., Syracuse, N. Y.; Nello Teer Construction Co., Durham, N. C.; Virginia Engineering Co., Newport News, Va.; Gregory and Poole, Raleigh, N. C., and the Dickerson Co., Monroe, N. C.

Fig. 6. On some jobs the soil-cement base is being topped with 100 lb. per sq. yd. of sand asphalt, an asphalt prime being applied a couple of days before the sand asphalt is put down.

Pneumatic Concrete Placers Speed Lining of Small Tunnels

***Contents in Brief**—Pneumatic placers for delivering concrete in lining four tunnels of the San Diego Aqueduct were designed to disseminate air through the concrete so as to prevent segregation of materials. The equipment, assembled in a train, was arranged for effective operation in tunnels of small diameter.*

CONCRETE LINING of four tunnels of the new aqueduct to serve San Diego was placed with recently developed pneumatic equipment in which operation centers around a single needle valve. The principal advantage claimed for this design is thorough dissemination of air through the concrete to prevent segregation of materials. Also of interest in the lining program is the effective arrangement of the various pieces of equipment in a train on 24-in. gage tracks to permit efficient operation in small tunnels.

The aqueduct (*ENR* March 6, vol. p. 362) is 71 mi. long and includes seven tunnels, each of which has a 6-ft. horseshoe section. Total length of the tunnels is some 4.3 mi. The tunnel work was divided into two contracts, one covering driving and lining of Rainbow (4,700 ft.), Lilac (500 ft.), Red Mountain (3,000 ft.), and Oat Hill (3,550 ft.) tunnels; the other contract was for driving and lining Poway (3,180 ft.), Fire Hill (5,850 ft.) and San Vicente (2,455 ft.) tunnels. It was in the contract for the group of four tunnels first listed that the equipment described herein was used.

Specifications for the tunnels invited bids on three sizes of horseshoe section tunnel, namely: 7 ft., 6 ft., 4 ft. 8 in. As bids on the 6-ft. section were only slightly more than for the smaller size, the 6-ft. tunnel was chosen because it would permit better construction methods and allow for future increase of aqueduct capacity. With this section, capacity of the tunnels is rated as 165 cfs.

The specifications also provided that, where necessary, steel rib supports be installed in the tunnels. These supports took the shape of a Gothic arch and were made of 4-in., 13.8-lb. H-beams with lagging of 2-in. boards. However, most of the aqueduct tunnels were driven through blocky granite and the supports were required only near portals.

In driving the tunnels, drilling was done with three pneumatic drills mounted on radial arms on a special flatcar. In hard materials, 25 to 27 holes of 6 ft. depth were drilled and loaded with 115 lb. of 60 percent dynamite. Mucking was done with air-operated machines, which loaded muck trains of 2½-cu.yd. side dump cars and 1-cu.yd. tip cars. Trains were hauled by battery-driven locomotives on 24-in. gage tracks using 30-lb. rails.

Forms for lining the arch end walls of the tunnels consisted of 12 collapsible steel forms in sections 20 ft. long on a traveler riding the 24-in. gage tracks. These forms were provided with hatches for use in observing the concrete as it was placed by the pneumatic equipment.

In addition to a battery-driven locomotive and a concrete batching plant, the placing equipment used for lining arch and walls included several 1¼-cu.yd. placers, an elevated track or "pass-over", an air tank, and enough 6-in. discharge pipe to extend through the pass-over, above the air receiver, and some 200 ft. into the space above the forms. During placing operations, air is supplied to the receiver through an air supply line fed by compressors located outside the tunnel. Included in the pipe support on the air receiver is a jack to change the elevation of the discharge pipe to correct for variations in the level of the roughly laid track.

Valve designed to disseminate air

The feature of these 1¼-cu.yd. placers for which unusual advantage is claimed is the needle valve beneath the gravity-feed concrete chamber. The curves on the needle are designed to disseminate air through the entire charge of concrete as it falls into the valve chamber, thus preventing formation of large air pockets and consequent segregation of materials as well as minimizing hazards of plugging in the discharge pipe.

Each valve is so located that, as the

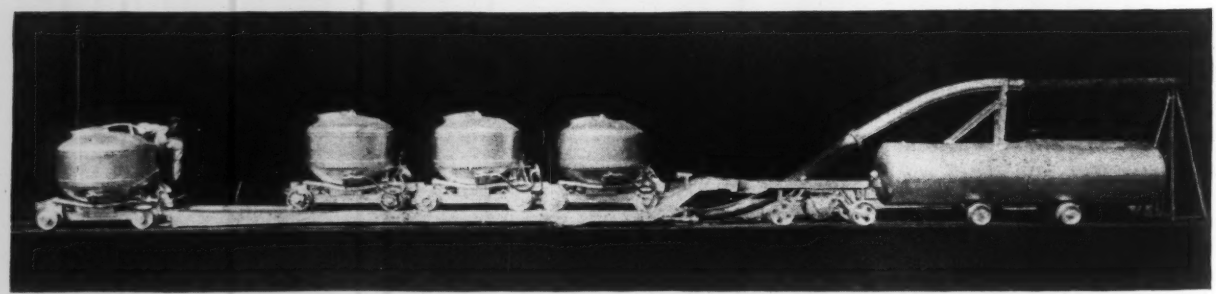


Fig. 1. Equipment used for placing concrete in San Diego Aqueduct tunnels in position for lining the arch and walls.

concrete drops by gravity through the conical shaped bottom of the placer, concrete is forced into the discharge pipe by compressed air coming in around the needle valve. The valve is turnip-shaped and when closed the spherical end is held tight against the valve seat by a spring. As the valve is opened by the operator's lever, air passes the needle and is dispersed, according to the patent claims, so as to thoroughly mix with the concrete. Air pressure that builds up in the valve chamber forces the concrete to move through the discharge pipe and into the forms.

A hatch cover inside the placer rotates in a horizontal plane to rest against a rubber gasket and seal the opening at the top of the placers. Air pressure inside the placer forces the hatch cover against the gasket, thus making the vessel air-tight during the discharge process. This cover can be quickly moved aside by means of a manually operated lever to permit the placer to be supplied with concrete or cleaned.

Concrete hauled a long distance can be agitated en route by means of an air tank brought with each train of placers and connected to each placer. This tank is separate and distinct from the air receiver used when placing concrete in the arch and walls. While en route an airtight cover closes the discharge of each placer. To this airtight cover, and also to the needle valve, are connected air lines from the tank that travels in each train. In this manner, air introduced in the bottom of each placer bubbles up through the concrete and out the hatch at the top, which is held in a loosened position during travel. Such air agitation is designed to prevent segregation of materials due to the jolting action of the moving placers and also to prevent formation of thickened plugs of concrete in the needle-valve chamber.

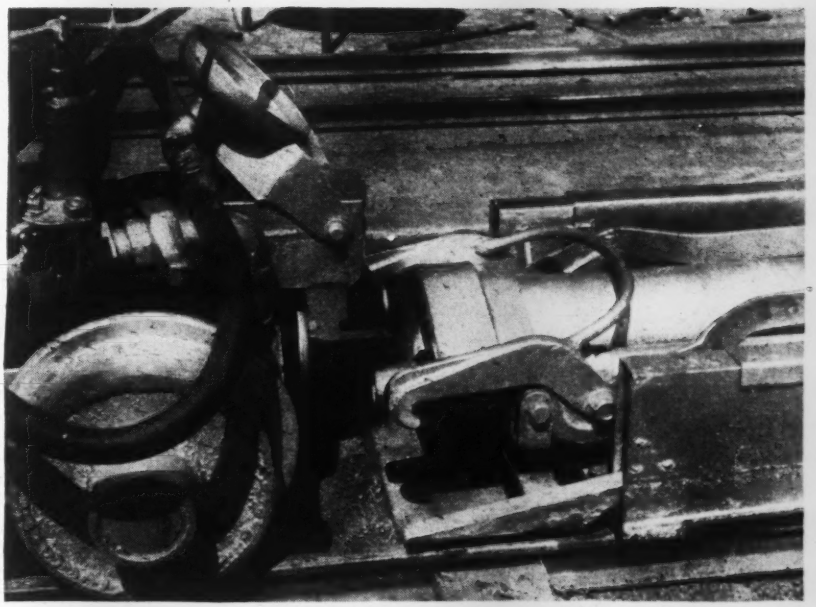


Fig. 3. To connect the placer with the discharge pipe, this quick-action coupling is used.

On the aqueduct job, agitation en route has not been necessary because the length of haul is quite short and an air-entraining additive is used with the concrete. This additive, according to project engineers, has satisfactorily prevented segregation of materials and has not materially affected the quality of the concrete.

Placers in groups of four

Although the advantages claimed for the placing equipment center around the needle valve, there also are noteworthy items in the arrangement of units and in the devices that facilitate and speed up operation.

An example of this is the connection by which a placer may be quickly attached to the discharge pipe and to the air supply used for delivering concrete. This air supply feeds through a 2-in. pipe into a steel manifold attached to the end of the discharge pipe. This manifold divides the air supply entering it between two 1½-in. outlets provided with protruding tapered fittings. As the placer approaches the discharge pipe, the tapered fittings are led into the tapered seats of a casting on the discharge end of the placer. Hooks operated by an eccentric lever pull the placer into position and lock it there so that the discharge pipe and the air inlets are seated and held firmly. Rubber gaskets prevent air leaks from the supply line.

After each placer is discharged, it is backed away from the discharge pipe and a ramp is thrust out of the pass-over apparatus by means of a double acting piston operated by air pressure. The empty cars are wheeled on the pass-over and they straddle the discharge pipe and the air feed. The ramp is then slid back into the pass-over by turning air into the other end of the piston. The next placer is then brought into position and discharged.

By the method just described, the

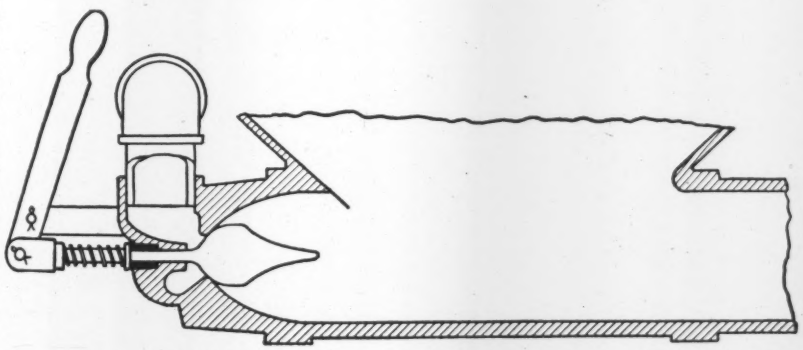


Fig. 2. Cross-section through the bottom portion of the placer showing the valve used to introduce air.

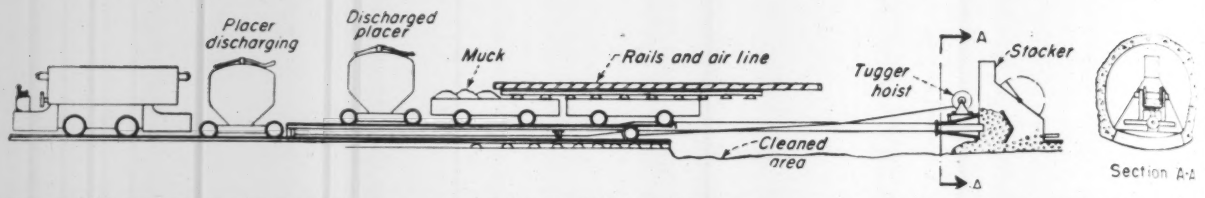


Fig. 4. To place the invert, two placers and two flatcars with low sides were used. Muck, rails, etc., were loaded on the flatcars as the placing work advanced.

contents of four placers or a total of 5 cu.yd. of concrete per train trip may be discharged into the lining forms. For efficient operation, it is desirable to have two locomotives, one to fill empty placers at the batching plant outside the tunnel and to be ready to enter the tunnel with a string of full placers when the other hauling the train of empties clears the narrow bore. On the aqueduct job, only one locomotive was available and progress for one shift a day averaged 100 ft. of arch placed.

Method of operation

Operation of this equipment is illustrated in Fig. 1. The operator is in position to discharge the placer by which he stands. He is operating the needle valve by means of a hand lever and has his other hand resting on the placer to get the feel of the concrete as it is discharged. In this manner he can judge the rate of discharge, which is controlled by the opening of the valve. The contents of one placer can be delivered in a half minute or the time can be lengthened to 4 or 5 minutes.

As the forms are filled, all of the placing equipment, moving as a unit, slowly backs away from the forms and the discharge pipe is thus withdrawn. This is accomplished by use of an air hoist mounted on a car located between the air receiver and the pass-over. The hoist is equipped with a cable, the free end of which is attached to the track as an anchorage. As the discharge pipe is withdrawn from the forms, its free length is supported on four-legged stanchions set on the rails.

Pneumatic placers for invert

This same pneumatic concrete placing equipment, with some modifications, is also used to place the invert. The discharge pipe instead of being elevated as is necessary for arch and walls, is suspended on the pass-over near the bottom of the tunnel. In placing the invert, a train usually consists of two placers and two flatcars with low side-boards. Air is supplied through an air hose which connects the air supply line to the pass-over and an air receiver is not used. Sufficient length of discharge pipe is used between the pass-over and the invert placer to leave room for workmen to clear the tunnel in advance of the invert placer. As concrete is being placed, muck, rail, air pipe, etc., are loaded on cars which ride the pass-over. Thus when empty placers are taken from the tunnel, muck-filled cars carrying rail and air pipe are also removed, and the process of pouring the invert is not delayed by cleaning-up operations.

The invert placer takes the form of a pyramid with a steel shell which spans the invert and rides on curbs left at the bottom of each side of the arch. The back end of this placer, or "stacker" as it is called by the contractor, is shaped to fit the bottom of the invert. As concrete is fed into the stacker, it is drawn slowly forward by an air hoist mounted on it and the back end thus acts as a screed, shaping the concrete in the form required for the invert.

Aqueduct built by Navy

The Aqueduct is being constructed for the San Diego County Water Authority by the United States Navy, which started it as a wartime emergency project. J. L. Burkholder is chief engineer and general manager of the water authority and Capt. A. K. Fogg, CEC, USN, is 11th Naval District construction officer in charge of the work. Details of the relationship between the Navy, the water authority, and other interested agencies were included in a comprehensive article on the aqueduct published in *ENR* March 6, vol. p. 362.

Poway, Fire Hill, and San Vicente tunnels are being built by W. E. Callahan Construction Co. and Gunther & Shirley Co. The contract for Rainbow, Lilac, Red Mountain and Oat Hill tunnels, work on which has been described in the foregoing, was held by S. A. Healy Co. which sublet the entire contract of J. S. Barrett Company and M. F. Kemper Construction Company as a joint venture. Concrete placing equipment described in this article was developed and patented by M. F. Kemper.

Cities Begin to Plan Cooperatively

Forty-two local governments in the Philadelphia-Camden area are forming a metropolitan planning agency to knit together expressways, airports, police and fire protection and other services into one integrated development plan.

The American Society of Planning Officials reports that the agency, formation of which has been approved, will draft development plans for adjacent areas of eight counties in Pennsylvania and New Jersey.

A budget is being devised allocating expenses of the organization among the various local governments involved.

The unit will begin operating as soon as a sufficient number of these localities ratify the budget and final report of the activating committee. There are 172 local governments in the metropolitan area, and the agency might eventually include most or even all of them as participants in the joint-planning program.

In addition to planning a unified network of public works for the entire area, the agency is also expected to work out a system of consolidated purchasing. Joint purchasing for municipal departments and city agencies currently is being practiced in Cincinnati, New York, Milwaukee and Los Angeles County. Chief advantage of such methods is saving of public funds through mass purchase of standardized items.

ACI Technical Sessions Feature Grouting, Air-Entrainment and Precast Concrete

***Editor's Note**—Discussion of current practices in design, construction and maintenance of concrete structures formed a large part of the technical sessions of the 43rd annual convention of the American Concrete Institute at Cincinnati, Ohio, Feb. 24-26, with chief interest centering on procedures for measuring the volume of air entrained in concrete. The following abstracts of technical papers presented supplement the news account of the meeting previously published (ENR March 6, vol. p. 355).*

SIMPLIFIED techniques and lightweight portable equipment for the rapid and accurate measurement of the volume of air entrained in fresh concrete have been perfected during the last year. These are far superior to the cumbersome "gravi-metric method" formerly used, reported Carl A. Menzel, senior research engineer, Portland Cement Association, Chicago.

Of several methods examined, two are believed to be superior in accuracy, simplicity and time required to make the test. One is the "pressure method" by which the sample of fresh concrete is placed in a closed, pressure-tight vessel and the entrained air-compressed. By applying Boyle's Law of pressure the volume of air present in the concrete is determined by the amount it is compressed under a given pressure. Equipment for making this test, which was developed by Mr. Menzel, is now being manufactured by the Central Scientific Co., Chicago, Ill.

The other method, termed the "rolling method," is based on the principle of direct volumetric change in which the sample of concrete is immersed in water and the escaping entrained air is measured. The pressure method, which takes only 8 min. to perform, after strike-off, is believed to be the more practical of the two although the rolling method, which requires from 12 to 16 min., after strike-off, ranks a close second.

These methods have proved to be equally dependable except for highly porous rock where the rolling method, to date, appears to be the only one that can be applied satisfactorily.

Foundation grouting presents one of the most controversial problems in dam design and construction, according to V. L. Minear, Office of the Chief of Engineers, War Department, Washington, D. C. Moreover, the successful treatment of any given foundation requires modification, in standard techniques to meet existing conditions.

Method of grouting important

Among the many questions involved in the proper foundation treatment for any major dam is what type of grouting to use. Shall it be blanket grouting, cutoff grouting or both? Blanket grouting, involving the drilling and grouting of a grid of shallow depth holes over an area extending from the axis to the heel of the dam before concrete is placed on the rock, will serve as an excellent reinforcement for the main grout curtain.

For high dams or those built on inferior rock, the cutoff treatment usually is needed. This consists of a two-line, staggered-hole arrangement. On the other hand, a single line of closely-spaced holes usually will make a satisfactory cutoff for low dams or those on reasonably tight rock.

Mr. Minear expressed the opinion that curtain grouting should be postponed until after the placement of concrete, as the weight of the superstructure will permit higher grouting pressure which, in turn, makes possible the injection of a grout having a lower water-cement ratio. He also advocates drilling a single line of closely-spaced holes, for permeability greater than that afforded by two or more lines of widely spaced holes.

Covering details and illustrating his talk with slides, Mr. Minear pointed out other features of good practice in grouting dam foundations. The size of grouting hole is not important, he said; it should be selected on the basis of economy in drilling and to provide the closest feasible hole spacing.

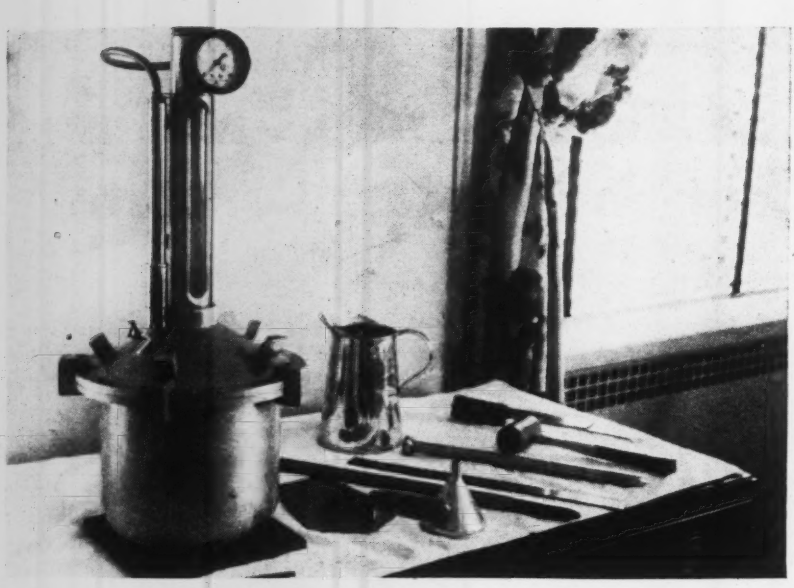
Although several materials are suitable for grouting, such as cement, rock flour, clay, asphalt and various chemicals, standard portland cement is considered the best material for a general-purpose grout, with the use of admixtures the exception rather than the rule.

Under normal conditions, pneumatic injectors are not conductive to the best results in grouting. They are uneconomical and dangerous to operate. Grout pumps are considered the ideal equipment for placing neat cement grout. They are safer, permit a close control of pressure, and are sufficiently flexible in operation to permit variation of the rate of introduction at will.

As to the best pressure to be used in grouting, there is no basis for establishment of a safe maximum pressure other than by experienced judgment. A widespread rule-of-thumb is to use a maximum pressure of 1 psi. per foot of depth from collar to packer.

The ideal procedure in rock grouting is to fill all cracks, crevices, open joints and bedding planes with grout having the lowest water-cement ratio that can be forced into the channels under permissible pressures.

In-so-far as is known, there is no pump on the market which can, in its commercial state, operate in an entirely satisfactory manner as a high-pressure grout pump. Among the most important modifications of



All apparatus for field measurement of the volume of air entrained in fresh concrete, by the "pressure method" can be transported in a 12x12x26-in. carrying case. Note small hand pump for providing air pressure temporarily attached to vertical stem of assembled pressure vessel.

such equipment, according to Mr. Minear, are (1) installation of pure rubber valves instead of "balata" or other similar valves; (2) replacement of cast iron liners with liners having a case-hardened steel sleeve and a highly polished inner wearing surface; (3) pistons provided in the commercial slush pump should be replaced with pistons made of medium-soft rubber molded onto a steel core and; (4) piston rods should be case-hardened since softer rods soon wear "out of round," permitting leakage through the gland.

Grouting by contract

In discussing Mr. Minear's paper O. T. Yates, engineer, Ohio River Division, Corps of Engineers, Cincinnati, expressed the opinion that blanket grouting should be done by the construction contractor, since this type of grouting can be more exactly specified with little probability of change during operation. Curtain grouting, on the other hand, can best be done by the owner's forces using hired labor, since it often requires many changes in contract specifications for which the contractor may demand higher prices. Also, since this type of grouting has become more complicated, unit bid prices are increasing out of proportion to other construction costs.

Problems in structural framing of precast concrete houses, illustrated with slides showing structural details of a two-story and a single-story duplex type concrete house designed to house personnel of the armed services in the Pacific Islands, were covered in a paper presented by A. Amirikian, head engineer, Bureau of Yards and Docks, U. S. Navy, Washington, D. C.

The use of precast elements in large-scale housing projects places special emphasis on the importance of structural framing, contends Mr. Amirikian. Consequently, design of such framing and its arrangement should be predicated on practical considerations, to assure adequate strength, adaptability of mass production, and economy of construction.

The use of precast framing often obviates the need of exterior veneers and, in some cases, also provides a decorative motif for the interior surfaces patterned in the castings. In such instances, the framing assumes an equal importance both as a structural problem and as an architectural medium, requiring the joint efforts of the architect and the engineer.

The ribbed panel, which constitutes the principal framing element, provides flexibility in design, higher relative strength and economy of construction. From a design standpoint, the ribbed panel presents in itself a framing system in miniature. The skin, or face slab which may be as thin as $\frac{3}{4}$ in. is designed as a two-way flat slab. It is reinforced with closely-spaced wire mesh.

Vacuum-processed concrete houses

How the vacuum process of precasting and construction is being applied successfully to multiple housing, was reported in a paper prepared jointly by K. P. Billner and Bert M. Thorud, president and chief structural engineer, respectively, of Vacuum Concrete, Inc., Philadelphia, Pa. The project in question, containing 585 one-story houses, is now under construction in Philadelphia, by McCloskey and Co., of that city.

Designed especially for utilizing the vacuum-processed precast concrete panels, these houses have three basic floor plans, two of 3-bedrooms and one of 2-bedrooms. Roofs are flat with overhanging eaves. Thus there is a large duplication of panels.

There are four main features in this plan of vacuum-processed housing, according to Mr. Thorud, who delivered the paper. They are: (1) extraction by vacuum of excess water from the freshly-placed concrete; (2) forms held in place by vacuum; (3) erection of hardened concrete units with a vacuum concrete lifter, and (4) joining of erected precast units by cast-in-place closures, which also are formed and quickly hardened by vacuum processes. Foundations and floors are cast-in-place concrete.

After the vacuum processing of the precast units has been completed, wall panels are given an exterior troweled surface of colored sand and cement, which serves as the final finish. Interior surfaces of wall panels, as cast, have exposed vertical studs and horizontal stiffening ribs to which are attached wood nailing strips. Rockwool bat insulation with vapor seal is placed between studs and ribs, and plasterboard is attached to the nailing strips to form the interior wall finish. Additional insulation placed over the concrete roof panels and between the floor and the foundation walls prevents dampness collecting on interior surfaces of the houses.

Mr. Thorud expressed the opinion that for low-cost multiple housing projects, this type of vacuum-processed precast concrete housing can be obtained at a cost substantially

below the cost of ordinary timber-framed construction.

Methods of preventing erosion of concrete by running water and effects of cavitation, based on laboratory tests and field observations of some Bureau of Reclamation dams, were presented by Walter H. Price, engineer, U. S. Bureau of Reclamation, Denver, Colo. He expressed the opinion that concrete can be made more resistant to erosion through the proper selection of mix proportions and treatment, but it will not withstand the severe forces of cavitation or the grinding action of rock, gravel and sand carried by the water.

In general, the erosion resistance of concrete increases as the strength of the concrete is increased. Removal of water from the plastic concrete by absorptive form lining or by vacuum processing materially improves its erosion resistance. Reduction of the water-cement ratio up to a limit of seven sacks per cubic yard increases resistance to erosion.

The air content of the concrete in hydraulic structures should be kept to the minimum required for durability and should be maintained below five percent. Except for hard troweling, ordinary finishes reduce the erosion resistance of concrete.

One example of serious erosion is that of the spillway bucket at Grand Coulee Dam, reported Mr. Price. Repair of this job is estimated to take eight years, since it is possible to work only three months out of each year. At present a floating steel caisson 115 ft. long by 57 ft. wide is being constructed for unwatering a 50-ft. section of the spillway bucket, preparatory to making the initial repair.

Methods of correcting defects in concrete tunnel lining of four railroad tunnels caused by disintegration, seepage, honeycomb, cracking and structural failures, as developed and used by his company, were explained in an illustrated talk by B. D. Keatts, regional vice president, Intrusion-Prepakt, Inc., Cleveland. The mortar used in this work contains standard portland cement, a mineral admixture, a pumping aid, fine sand and water, which remains in a satisfactory flowable condition for periods up to 2 hours. It is pumped into graded, coarse aggregates packed behind forms placed over areas from which the disintegrated concrete has been removed. The resulting concrete is non-shrinking and bonds well.

Connecticut State Building Code Voluntarily Adopted by Communities

Prentice White
State Housing Administrator
Hartford, Conn.

Within less than a month of the publication of a state building code for Connecticut, 49 of the state's 169 cities and towns have expressed an interest in adopting the code. The state code is not mandatory until voluntarily adopted by a municipality, and then it is enforced locally. Under a special act of the legislature, it may be adopted by ordinance without expense to the municipality, and it will be amended by the State Housing Authority from time to time to keep it up to date.

The new code is the result of studies made by the Connecticut State Housing Authority shortly after its creation in 1943. The findings probably parallel what would be found in any state: Many municipalities had no code. Where codes existed, some were outdated. Most of them were too lengthy and involved and specified in too much detail the manner in which materials could be used. There was no uniformity of codes throughout the state. The cost of preparing and maintaining an up-to-date code was beyond the means of a large majority of the cities and towns, and state law, requiring that building ordinances be published in a local newspaper, as well as the printing of a code, entailed so much additional cost that the adoption of a building code by a small municipality would immediately be reflected in its tax rate.

Conclusions and recommendations

After analyzing the results of this study, the State Housing Authority concluded that:

1. Expanding construction operations, particularly in small communities, make it imperative that there be some control over the manner in which buildings of all types are constructed.

2. If there are to be controls, they should be clearly and concisely stated in a code that will regulate the quality of structures without being over-restrictive regarding the methods used in their construction.

3. Any building regulations adopted should be such as may be readily revised as new sound construction methods and materials are developed.

4. It would be desirable to have a basic uniformity in all building regulations in the state to accomplish savings in the costs of design, materials and construction, and also relieve the problems of architects, engineers and builders who are normally faced with a conglomeration of varying regulations in any given group of communities.

5. The adoption and maintenance of sound, modern building regulations should entail little or no expense to a municipality excepting those costs related to local enforcement.

With these factors in mind, the housing authority called together a committee of representatives of all of the various Connecticut interests concerned with construction to act in an advisory capacity during the preparation of a recommended state building code. The services of a building code engineer, the late Rudolph P. Miller, were engaged, and work on the development of a code was started in 1944.

The code was published in February of this year. It utilizes by reference the nationally accepted standards of 17 major associations concerned with construction, public health and safety, insurance, etc., and as these standards are revised by reason of new developments, the state code will be revised.

Fig. 1. U. S. Dredge Jewett removes final earth plug in cutoff pilot channel at Hopedale Bend on the Arkansas River.

Army Engineers Complete Dredged Cutoff to Control Meander of Arkansas River

Austin B. Smith
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Mississippi River Commission
Vicksburg, Miss.

***Contents in Brief**—Dredging the Hopedale cutoff on the Arkansas River, with contract and U. S. Engineer dredges, encountered difficulties not often found in such work. Large buried trees, cypress stumps and heavily ballasted willow mattresses increased the difficulties of excavation and caused many shutdowns of equipment.*

On Nov. 4, 1946, at 12:30 p. m., the remaining earth plug was dredged through by U. S. Dredge Jewett, opening Hopedale cutoff pilot channel to the Arkansas River's flow. In a little less than two months two cutterhead dredges had removed nearly 2,500,000 cu. yd. of channel excavation, involving some of the "dirtiest" dredging to be found in river work. The cutoff, located on the Arkansas River 23.5 miles above its mouth, near Yancopin, Ark., and directly above the Missouri Pacific Railroad bridge, shortens the chanel 2.9 miles.

The Arkansas River, a major tributary, joins the Mississippi River 481 miles above New Orleans, La. Its flow ranges from a minimum of 800 cfs. to a maximum of about 813,000 cfs. during the 1927 flood. It is an alluvial stream and, except at Pine Bluff and at historic Arkansas Post, Ark., where high ground and early quaternary formations are encountered, the river meanders in a flood plain of its recent alluviation, marked principally by oxbow lakes and other meander scars. In its present meander belt, occupied for thousands of years, the river has devoted itself to shifting its trace back and forth over a 5-to-10-mile-wide strip.

Hopedale Bend provides a classic example of the difficulty in maintaining a levee line along a meandering river where the levees are located within the stream's meander belt. The southward march of the river's meander, rapidly caving the concave bank, has frequently endangered the controlling levee.

In 1941, when the rate of caving in the bend increased and it was discerned that the controlling levee soon would be endangered, construction of a large setback was begun. Before it could be completed, however, the bank had caved to a point necessitating the construction of several emergency loop levees and the dredging of a "shoofly" channel across the point bar to retard caving in the bend. These operations, completed in March, 1942, involved the excavation and placement of some 5,208,000 cu. yd. of material at a cost of about $544,000.

Following completion of the large levee setback in 1942, the river rapidly migrated back into its former

channel in Hopedale Bend and extended its meander trace southward. By April, 1946, the river was again a potential threat to the security of the controlling levee. In July, the river was only 750 ft. from the toe of the levee, and records of past bank-caving rates indicated that this amount of foreshore could be caved away in one high-water season.

With the necessity for action during the 1946 working season apparent, aerial and hydrographic surveys were obtained for a distance of three miles above and below Hopedale Bend and a detailed study made of alternative methods of treatment; namely, levee setback, cutoff, or channel stabilization by means of pile dikes or some form of bank protection.

Preliminary studies disclosed that the existing poor foundation conditions would make further levee retirement difficult and expensive. The lower end of a setback would be limited by the Missouri Pacific Railroad line, which crosses over the levee near the lower end of the bend. Consequently, such an improvement would have a comparatively short life unless the river could be stabilized.

Furthermore, if the bend were allowed to migrate downstream, a long section of the railroad track would be along the river front with the channel approaching the river crossing (Yancopin bridge) at a very acute angle. Moreover, stabilization of Hopedale Bend was not entirely satisfactory from the standpoint of channel alignment. It posed many problems of maintenance, and represented a large initial cost of construction.

Cutoff had many advantages

In the final analysis, a cutoff pilot channel offered the best means of controlling the river's meandering at Hopedale Bend. Its advantages were many. Such a cutoff would move the river out of Hopedale Bend, provide good alignment and offer the most economical and permanent solution of the problem. It also would add security to the Yancopin bridge by providing a channel normal to the structure. Hence it was favored by the railroad company.

An estimate of the quantities involved showed that the cutoff pilot channel could be completed on or before Nov. 15, provided two cutterhead dredges with 1,500 to 2,000 hp. on the main pump and 20-in. dia. discharge pipe were mobilized immediately.

Previous experience had shown that the hydraulic effect of a cutoff, such as the one at Hopedale Bend, is carried upstream with no noticeable velocity changes downstream. And with a reduction in channel curvature, some minor aggradation of the river bed may be expected below a cutoff in an alluvial stream such as the Arkansas.

Precedent for cutoff

Premised on the above factors and the excellent results obtained with Redfork cutoff, constructed for similar reasons in 1944 at a point six miles upstream from Hopedale Bend, a cutoff was decided upon and Nov. 15 was set as the deadline date for completion of the pilot channel. Uncertainties, such as the time required to get over-draft dredges 25 miles up the Arkansas River, led to the decision to do the work by government forces, using one or more contract dredges leased on an hourly rate. While the dredge plants were being mobilized, plans and specifications were prepared, a 2,000-ft. wide, 5,000-ft. long strip of right-of-way was purchased, and clearing and grubbing operations were initiated.

Plans and specifications provided for the construction of a cutoff pilot channel having a bottom width of 150 ft. at the project grade, with side slopes taking the natural repose-angle of the material. Clearing and grubbing extended 400 and 250 ft., respectively, on each side of the center line, and the excavated material was disposed of along the left side of the river channel directly below the head and foot of the pilot channel. Beginning at the upper end, (Sta. 0 + 00) the center line of the channel extends for 2,200 ft. on a tangent, then swings about 10 deg. left and continues on a second tangent for a distance of 3,300 ft. to the end of the project at Sta. 55 + 00.

Two self-propelled cutterhead dredges were engaged for the job. One was the *Duplex*, which had 1,600 hp. on the main pump and a 26-in. discharge pipe. It was leased for a 3-month period at an hourly operation rate from the Sternberg Dredging Co., St. Louis, Mo. The other plant—the U. S. Dredge *Jewett*—was obtained on a loan rental basis

Fig. 2. Dredging was carried forward from both ends of the cutoff, with the dredge Duplex (foreground) working upstream and the U. S. Government dredge Jewett working downstream.

Fig. 3. Completion of the pilot channel on Nov. 4, with subsequent scouring of the Arkansas, shortened the river 2.9 miles and gave a more direct approach under the Missouri Pacific Railroad Bridge.

from the Louisville Engineer District. This dredge had 1,500 hp. on the main pump with a 20-in. dia. discharge pipe.

The dredge *Jewett*, carrying a draft of 6 ft. 3 in., reached the mouth of the Arkansas River on Aug. 9 and began dredging at the upper end of Hopedale cutoff on Sept. 13. The dredge *Duplex*, with a draft of 7 ft., reached the mouth of the Arkansas River on Aug. 21 and began dredging at the lower end of the cutoff on Sept. 10. Because of the shallow depth of the river, it was necessary for these two dredges to stop and deepen 22 crossings in making the 25-mile journey up the Arkansas River.

Clearing and grubbing work, performed largely by local labor aided by tractor and bulldozer equipment, was started Aug. 19 and completed Sept. 21.

Excavation of the cutoff pilot channel proved to be a "dirty" dredging job. The *Jewett* encountered "drift wracks," buried cypress stumps and large buried trees, and consequently had much shutdown time to clean the pump. This resulted in slow digging. The *Duplex* had to dredge angling through a thick willow bank protection mattress heavily ballasted with one-man and lesser size stone. It was 15 days working through the mattress. A cutterhead was lost, and "rock in the pump" accounted for daily shutdowns of as much as 12 hours, and averaged 9 hours per day during this period.

After working through the mattress, the *Duplex* widened the cutoff pilot channel an extra 100 ft. on the upstream (north) side below Station 47 + 00, in order that the railroad company might turn its bridge bank protection into the bank to prevent flanking. Then it excavated the pilot channel up to Station 28 + 00, the lower limit of the dredge *Jewett's* excavation.

The dredges *Jewett* and *Duplex* excavated 1,180,000 and 1,312,000 cu. yd., respectively, in the construction of the cutoff pilot channel. In addition, the *Duplex* placed 101,000 cu. yd. of fill in the old channel below the head of the cutoff immediately after the pilot channel was opened in order to divert more of the flow through the pilot channel.

A made-to-order rise in the Arkansas River permitted the dredges to be flushed out of the Arkansas River immediately after completion of the pilot channel on Nov. 4, 1946.

Much meandering in the past

Some idea of the difficulty of controlling the alignment of the lower section of the Arkansas River can be gained from this brief description of the stream itself. As a tributary stream, its lower 75 miles of channel is subject to "run-out" flows from Nov. 15 to June 1, the peak discharges and durations of which depend upon the stages encountered in the Mississippi at its mouth. Water surface slopes of as much as 2.8 ft. per mile have been observed in this lower section. By virtue of "run-out" flows and an easily eroded flood plain, this section of the river is characterized by rapidly caving banks, cutoffs and avulsions.

Meander bends caving at the rate of 500 to 1,000 ft. in one high-water season are not uncommon. In one typical 20-mile reach, eight cutoffs were chronicled between 1839 and 1946. Maintenance of the Yancopin railroad bridge since its construction in 1903 has required the replacement of channel piers and approach structures on a number of occasions following their destruction by the river during periods of high "run out" flows.

The adopted project for Mississippi River flood control provides for the protection of all lands south of and below Pine Bluff, Ark., by means of 66.5 miles of levees. This levee line, a vital link in the Mississippi River flood control project, takes off from the high ground at Pine Bluff, and generally parallels the Arkansas River, becoming the west bank Mississippi River levee near Arkansas City. This levee was crevassed at Pendleton, Ark., ten miles above Yancopin, during the 1927 flood, inundating thousands of acres of rich farm land in southeastern Arkansas and northeastern Louisiana.

The present south bank levee below Pine Bluff, follows generally the location selected by early plantation owners in protecting their lands bordering on the river. Consequently, it is for the most part located well inside the river's meander belt and is frequently menaced by rapidly caving bends during floods, and periods of "run-out," which may occur any time after Nov. 15. To protect this vital levee line, emergency dredging, cutoffs and bank protection work are resorted to when the levee cannot be readily set back. Recently, such corrective measures were used at Pine Bluff, Fletcher Bend, and the Redfork cutoff, all in Arkansas.

All work in connection with the Hopedale cutoff was planned and completed under the direction of the Mississippi River Commission and the Vicksburg Engineer District, at a cost of approximately $450,000. It was completed ten days prior to the target date of Nov. 15. As of Nov. 20 the cutoff pilot channel was developing satisfactorily and bypassing sufficient flow to alleviate caving in Hopedale Bend.

Factory Designed for Residential Area

***Contents in Brief**—An attractive appearance was a necessity for the new clothing factory and store being erected for Bond Stores, Inc., in Rochester, N. Y., because of its location in a neighborhood zoned for residences. Among the structural novelties incorporated in the design of the plant are the steel rigid frames supporting the roof over the second-floor cafeteria and the system of steel beams carrying the canopy and spandrel wall at the curved entrance to the store.*

AMENDMENT of the zoning regulations of Rochester, N. Y., made possible the erection in a residential section of that city of a clothing factory and retail store for Bond Stores, Inc. City officials took this action because the handsome appearance and layout of the plant will not detract from the attractiveness of the neighborhood. In addition to the architectural treatment, several structural features are of much interest.

One of these—the system of steel beams supporting the canopy and spandrel wall at the curved entrance to the store—is a direct consequence of the architectural design. Another—the steel rigid frames carrying the roof on a 120-ft. span over the second-floor cafeteria—is one example of many provisions incorporated to make working conditions for the employees as pleasant, convenient and comfortable as possible.

Representing an investment of about $6,000,000 for buildings alone, with an additional $1,500,000 earmarked for equipment, the project consists of a factory, an administration building, a boiler house, a garage and a retail store. Overall floor space will be about 780,000 sq. ft. The new facilities will supplement the existing Bond plant in another section of the town, with the ultimate objective of employing 11,500 workers.

For this addition, a 56.5-acre tract fronting on North Goodman and Northland streets was acquired. The current program occupies 17.5 acres, leaving ample room for possible future expansion. Because the site is in a residential section, the plant will be serviced only by trucks, since there are no railway lines.

Architectural features

Elaborate landscaping, ornamental railings and wide expanses of sash are utilized to enhance the appearance of the project. Designed to harmonize architecturally, the buildings have exterior walls of face brick, with limestone trim, and large areas of plate glass have been incorporated in deference to the traditional preference of clothing workers for natural daylight (Fig. 1).

Surmounted by a 6-story, 100-ft. high brick tower, the main entrance and executive offices are located at the junction of the administration building and factory on the nearly 1,000-ft. combined store and factory frontage on North Goodman St. A two-story feature window, composed of two thicknesses of glass separated by an air space, faces the main entrance and backs a widely sweeping circular stairway leading to the second-floor executive offices. Travertine marble is used for the main lobby and the stairs. The frame of the feature window, the stair railing and the doors are of bronze.

Boiler house

The boiler house is placed several hundred feet from the plant, strategically located to service later additions without new construction, and is connected to the main building by a service tunnel. U-shaped, 78x87 ft., with 32 ft. clear height to the underside of the trusses, the building is of steel frame construction, inclosed on three sides with brick and tile, while the fourth side, facing north, has movable sash installed for ventilation.

One wing of the U contains the substation and electrical equipment and the other wing an incinerator. Smoke and fumes are either trapped or carried beyond the area by a brick stack 125 ft. high. Three oil-fired boilers furnish heat to the hot water system, which is used throughout. All radiators are covered to heighten

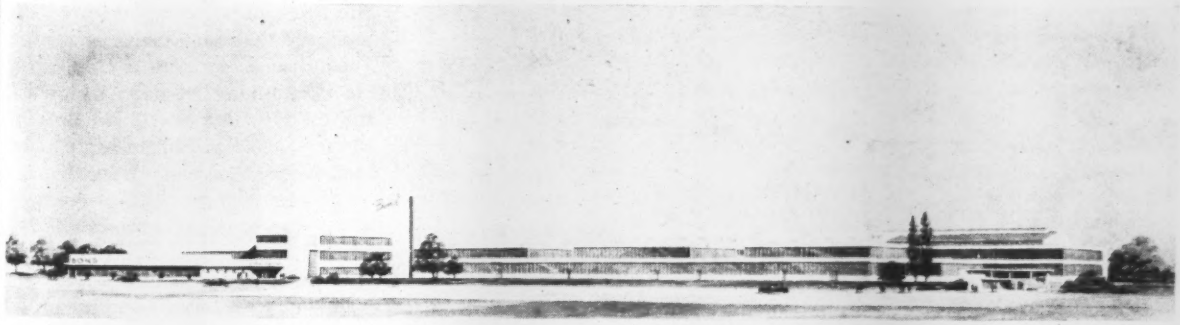

Fig. 1. Accent was placed on attractive appearance in the design of a clothing factory and store in a neighborhood zoned for residences. Canopy over curved entrance at left is supported by cantilevered beams.

the impression of neatness and cleanliness.

The factory, the three-story administration building, and the tower are reinforced concrete structures, whereas the retail store and garage are of structural steel construction. Structural steel was used in the store to provide large, unobstructed floor space.

The store is one story in height, of triangular shape, with about 18,000 sq. ft. of floor space and frontage of 200 ft. on North Goodman St. and 420 ft. on Northland St. In addition to small windows for spot displays, it has a main window 140 ft. long, with an approximately 7-ft. overhanging canopy running full length above. The entrance at the street intersection is curved, and there are separate customer parking and special carriage entrances.

Roof cantilevered at entrance

Because of architectural requirements, structural supports cannot be located at the curved entrance to the retail store. Complicated by the overhanging canopy, the steel framing in this area is of necessity somewhat intricate (Fig. 2). A double cantilever system is used requiring only two corner columns and no intermediate construction.

Beam B5 is placed diagonally between the two columns and three parallel beams—marked B17 and B18—cantilever over its top flange with the interior ends supported on B19. The exterior ends of B17 and B18 are connected by channels B8 and have hung from them a lower-level cantilever system. The second system consists of beam B9, which supports the spandrel wall; the radial group of double channels B6, on which B9 rests; and three beams that transmit the canopy load to B6. The radial cantilevers B6 near mid-span are hung from either B17, B18, or B8, and at their interior ends are suspended from the lower flange of B5.

Factory planned for daylighting

Occupying the greater part of the built-up area, the 670x542-ft. factory is of reinforced-concrete flat-slab construction, varying from one to three stories in height. In the layout, particular attention centers on the proper sequence flow of materials in process to eliminate unnecessary handling and cross-flow. Technological requirements necessitated different column spacings in the east and west portions of the building—the west portion having 24-ft. 6-in. by 25-ft. 6-in. bays and the east portion 24-ft. 6-in. by 28-ft. 6-in. bays.

To provide daylight throughout the manufacturing section, seven courts were arranged, permitting uniform lighting in all second floor shops. Proper ventilation is achieved by an arrangement of twelve fan rooms, four of which are located on top of the second-floor shops. Full-glazed tile walls are general throughout, both for maximum cleanliness and light reflecting value. Ceramic-glazed tile is used on a few opaque walls of the second-floor shops. Floors are finished with asphalt tile to provide the resilience to which clothing workers are accustomed.

Employee facilities

Numerous features have been incorporated in the layout to attract and hold the highest type of labor. Special employee parking is convenient to the plant's main employee entrance, where a canopy-type bus shelter is provided. Inside the entrance are personnel and employment entrances and a hospital completely equipped for any need. Lockers for men and women workers are on the main floor, and toilet rooms are spaced at frequent intervals.

On the second floor are the kitchen and the cafeteria feeding 2,500. The cafeteria has a high arched ceiling, complete ventilation, and full sash on one end, with clerestory sash along the sides. Adjacent to the cafeteria are lounge rooms with provisions for converting the area into a huge auditorium for employee activities.

Rigid frames support cafeteria roof

The construction of the large cafeteria is an outstanding feature of the manufacturing building. To obtain unobstructed floor space, rigid frames spaced 25 ft. 6 in. on centers, spanning about 120 ft., and constructed from 36-in. wide-flange 150-lb. beams, with built-up welded columns, are used to carry the high ceiling (Fig. 3). The legs are 21 ft. high, and the beam has a rise of 10 ft. These frames are erected on top of the second-floor flat-slab construction, and the resulting horizontal thrust of about 65,000 lb. is transmitted from base to base of each frame column by means of four 1¼-in. square tie bars. Short tie pieces are welded to the bottom of the base plate, as shown in the detail (Fig. 3) and are furnished, together with the base plate, by the structural steel company, whereas intermediate tie rods are furnished by the reinforcing-bar manufacturer

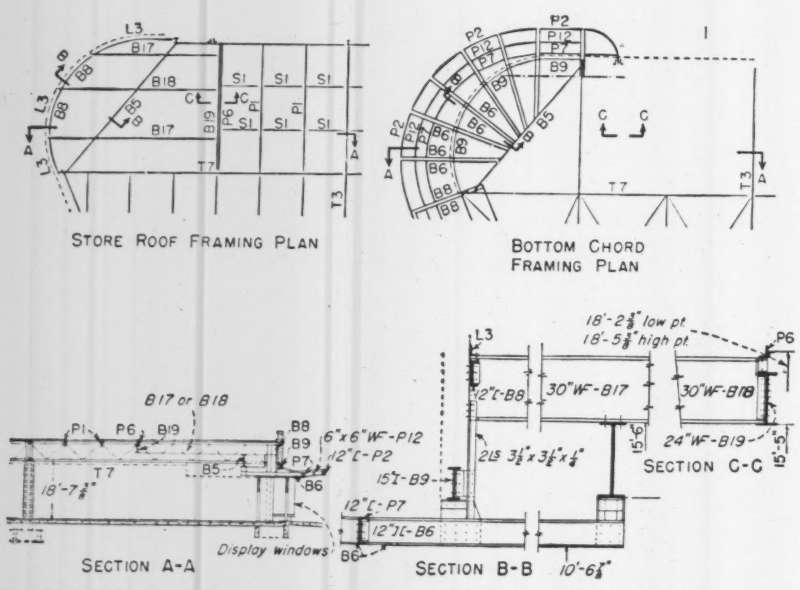

Fig. 2. A double cantilever system is used to support the spandrel wall and overhanging canopy to avoid structural obstructions at the curved entrance to the retail store. Beams B17 and B18 are supported on B5 and B19.

and spliced and welded together in the field.

The 2-in. thick, L-shaped base plate, which rests on four adjusting screws, is set together with the reinforcing steel, and concrete is poured before the rigid frames are erected. By leaving a 2-in. clearance between the outside face of the column and the vertical leg of the base plate, it is possible to adjust the frame during erection and then insert the necessary field shims to transmit the horizontal thrust from column to base plate. After adjustment, these shims are tack-welded to secure their position.

The important problem of securing the inside flange of the rigid frame at the rounded corner against buckling was solved as indicated in Section A-A. A diaphragm is extended from the inside flange of the frame to a diagonally inclined 12-in. channel that runs the whole length of the building and forms, together with the vertical end purlin, a rigid bracing member.

The roof over the cafeteria consists of 2-in. slabs of mineralized wood fiber bound under pressure with portland cement, with ¼-in. cement field finish over which waterproofing is placed. The 20-in. wide slabs are supported on light-gage U-shaped rail-post sections spaced 20 in. on centers and tack-welded to 12-in. purlins placed 8 ft. on centers. Weighing about 10 lb. per sq. ft., the slab furnishes heat insulation equivalent to 1 in. of cork.

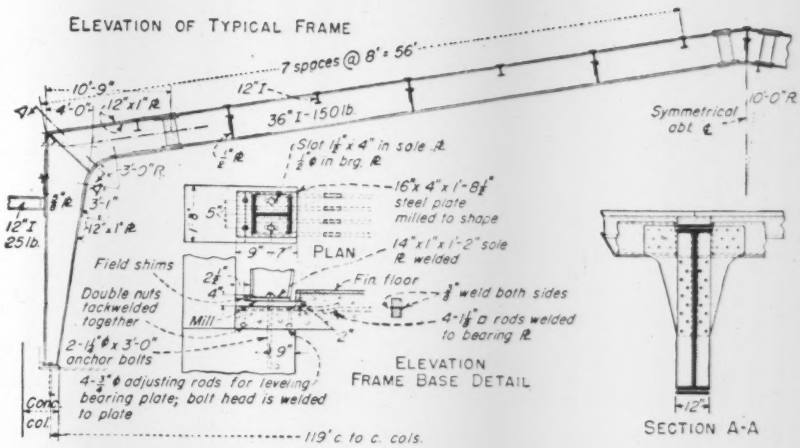

Fig. 3. Steel rigid frames carry the roof over the second-floor cafeteria. Horizontal thrusts are resisted by tie rods welded to the base plate at the bottom of the legs, which are 21 ft. high. The beam has a rise of 10 ft.

Ground was broken for the project in the fall of 1945, with John B. Pike & Sons Co. of Rochester as general contractor.

The plant was designed by Albert Kahn Associated Architects & Engineers, Inc., of Detroit, for whom Alfred Zweig was in charge of the structural work.

Streamlined Zoning Law Basis For Master Plan

Emphasizing simplicity in urban development, Milwaukee's new master plan calls for a simplified ordinance to reduce zoning classifications from 84 to 15 according to the American Society of Planning Officials.

Milwaukee's master plan, constituting latest addition to the roster of big cities providing for long-range redevelopment based on comprehensive planning, has just been submitted to the city board of land commissioners.

The plan calls for a major street system for Milwaukee, a civic center, landscaped parking areas near all public buildings, recreation areas and parkways along the Milwaukee River and Lake Michigan, and relocation of transportation terminals. Capital improvements included in the plan would cost $72 million.

A prime object of the plan is to provide for orderly redevelopment of the city to help stop the flight to the suburbs of residents seeking respite from city inconvenience, noise and dirt. The new plan is designed to bring advantages of suburban living into city areas while maintaining inherent benefits of the city.

Space for living

The 15 proposed zoning classifications cover land-use varying from agricultural to residential and industrial. In some residential areas, as much as 10,000 sq. ft. per one-family dwelling would be required. Areas zoned for elevator type apartments would require 400 sq. ft. per family housed.

In commercial and industrial areas, off-street loading would be required. Planners recommend also that a stringent smoke-control ordinance be tied in with the proposed zoning ordinance to insure against industry adversely affecting in any way the value of residential districts.

Complexity of Milwaukee's present zoning ordinance, which planners say is obsolete, is indicated by the fact that three separate land-use maps are necessary for graphic representation of its 84 rigid zoning gradations. The new ordinance is simple enough to be presented on one map.

The $72 million estimated cost of carrying out the master plan would be met about two-fifths by the city and one-fifth each by the county, state, and federal governments. City officials say it is not the object of the master plan to transfigure Milwaukee into a modernistic city at enormous expense, but rather to provide a long-range framework within which capital improvements may be made.

Other cities to complete master plans within the past year include Providence, R. I., and Richmond, Va. The plan for Richmond—a city approximately one-third the size of Milwaukee—includes specifications for projects costing an estimated $130,000,000 during the next 35 years.

Baffled Basins Improve Sedimentation

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Contents in Brief—Transverse, submerged baffles in settling basins have proven their worth at the Montebello water filtration plant. Not only are cross-currents and eddies reduced, improving uniformity of cross-sectional flow, but also deposition is increased, particularly at the first baffle.

INSPECTION of sedimentation basins that were drained for sludge removal shortly after Baltimore's Montebello filtration plant was placed in operation in 1915 revealed a striking lack of uniformity in "mud" deposits throughout the tanks. This raised a question as to the possible unfavorable effect of undercurrents and eddies upon subsidence characteristics.

Early experiments to determine the influence of such underwater movements were conducted by James W. Armstrong, the first superintendent of the Montebello plant (see *Jour.* Amer. Water Works Assn., 6; 160; 1919). Using colored markers above aluminum floats started at the basin inlet, the respective progressive positions were located at six-minute intervals. In the center of the tank, floats generally moved forward at relatively high velocity, but those at the outer edges moved erratically; and some caught in eddies remained in the corners for several hours. This demonstrated lack of uniformity in cross-sectional flow suggested use of baffles to improve distribution of sediment.

The problem, then, hinged upon the best location for baffles in sedimentation basins, 320 ft. long, 230 ft. wide, and 15 ft. deep, built of reinforced concrete. Being partly divided by a central wall (240 ft. long) to create around-the-end flow, they are, in effect, similar to basins 640 ft. long and 115 ft. wide. Flocculated water enters on one side of this wall, passes around it, and is then withdrawn on the opposite side. With a water depth of 13.8 ft., the total volume is about 1,015,680 cu.ft.; and the detention period is 3.2 hr. at 100 mgd.

To subdue erratic currents and to maintain movement of water through the split basin in nearly parallel lines, wooden baffles were installed at two points, transverse to the direction of flow. The baffles, shown in Fig. 2, extend 9.3 ft. above the floor, thus leaving a 4.5 ft. overflow.

Constructed of $\frac{7}{8}$ x 6 in. T. & G boards on a 2 x 4 in. horizontal stringer and vertical stud frame, the baffle walls are held in place by $\frac{3}{4}$ in. expansion bolts sunk into the concrete floor, and trussed vertically by 2 x 4 in. diagonal braces. The latter are spaced 8 ft. on centers, reaching from the end of 4 x 4 in. sleepers stretched along the floor to a point just beneath the overflow section.

The overflow section is made of narrow sheeting, also $\frac{7}{8}$ in. T & G, supported on 2 in. ribs spaced 4 ft. apart. To insure easy overflow, these sections are curved downward toward each edge providing a parabolic surface area of 4 sq.ft. per lin.ft. of baffle.

The primary baffle is located about 230 ft. from the entrance; the secondary about 70 ft. from the free end of the central division wall in the outlet section. Hinged float-operated wooden gates, opened only to facilitate removal of the sediment waters during manual-cleaning operations, are spaced at random across the wall.

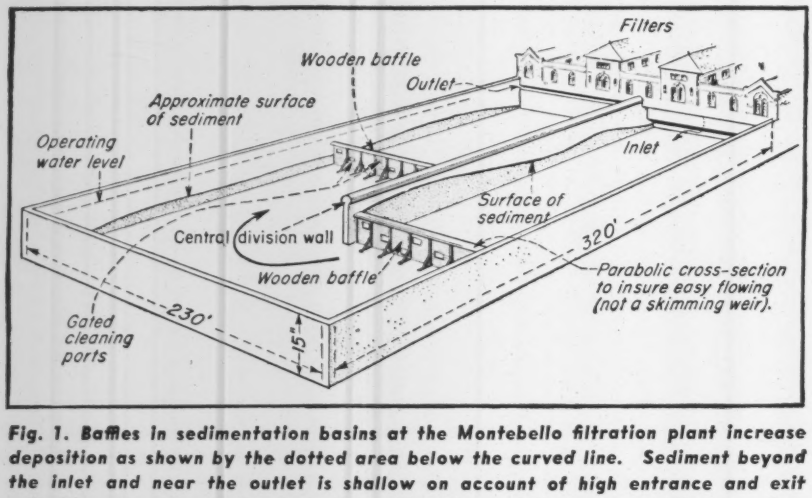

Fig. 1. Baffles in sedimentation basins at the Montebello filtration plant increase deposition as shown by the dotted area below the curved line. Sediment beyond the inlet and near the outlet is shallow on account of high entrance and exit velocities through restricted openings. Settling before the first baffle is particularly effective.

Results are charted

Following dewatering, surface elevations on deposited silt were recorded on several occasions. These indicated that sediment was deposited with greater uniformity after baffling, as anticipated, the first barrier being especially effective in obtaining increased deposits.

In Fig. 1, compiled from such measurements, is shown the excellent "build-up" of mud behind this baffle. Sediment at the tank entrance is very shallow, a condition caused by increased entrance velocity through a narrow horizontal inlet that adversely influences bottom velocity for a dis-

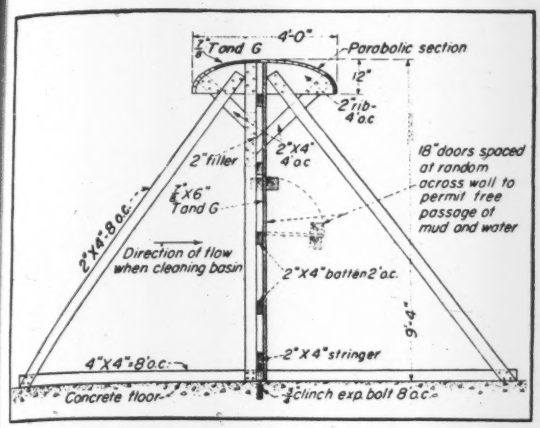

Fig. 2. Gated ports (shown at the right) at irregular spacing along the wood baffles aid sludge removal. Powerful fire streams are used for flushing. A parabolic cross-section of the top of the baffle (shown at the left) insures smooth overflow and precludes skimming effects. Cleaning gates are operated by wooden floats.

tance of about 50 ft., and restricts sediment in this area to about a 4 ft. depth composed primarily of heavier particles. Thereafter, the surface of deposits rises in a curve, seemingly parabolic in longitudinal section, to a point slightly higher than and several feet in front of the baffle, and then, descends to the edge of the overflow section.

Beyond the first barrier, sedimentation is accomplished uniformly, except at the outlet section, where increased velocity through a narrow slot again reduces deposits. Across the parabolic section the velocity, as estimated by Armstrong, is increased from 2 ft. per min., to from 21 to 24 ft. per min.

Turbidity of raw water averaged 18 ppm. during a four months period between surface measurements; the highest daily reading was 60 ppm.

Early experiments and installation of the baffles were carried out by the personnel of the Bureau of Water Supply. At present administrative control resides in this bureau, a section of the Department of Public Works, of which Nathan L. Smith is chief engineer, Leon Small, water engineer, and the author, associate engineer in charge of plant operation.

Evanston to Experiment With Fluorine in Water

Highlight of a recent conference of Illinois water plant operators was a discussion on "Fluorides in Water" by W. H. Tucker, commissioner of health, Evanston, Ill., and R. J. Faust, chief of the water supply section, Michigan Department of Public Health. Mr. Tucker described the experimental addition of 1 ppm. of sodium fluoride to the Evanston water supply in a full-scale 12- to 15-year experiment which was started January 1, 1947.

The experiment, which is designed to learn the effect of fluoride addition in the prevention of dental decay, will be a cooperative program sponsored by the Illinois Department of Public Health, the University of Chicago, and Evanston medical and dental societies.

The chemical will be added to the city's water supply at its filtration plant, since experiments elsewhere have shown that best results are obtained by the addition of the fluorine just prior to filtration. Studies will involve two school groups, the first ranging from six to eight years, and the second from 12 to 14 years of age.

Full-mouth X-rays, examinations and detailed questionnaires will have been compiled on each child before the program is inaugurated. Re-examinations will be made yearly until a group is finally reached who were born after the addition of fluorine was started. Community support is shown by the fact that 99 percent of the questionnaires have been completed and returned.

Cost of adding fluoride to the water supply of Evanston, a city of 80,000, is estimated to be about $40,000 annually, or a total of $600,000 over the proposed 15-year period.

Reporting on two Michigan cities now adding 1 ppm. of fluorine to their water supplies, Mr. Faust said that the Michigan Department of Public Health has definitely discouraged other towns from adding fluoride at this time, although 25 have expressed a definite interest in doing so. The first definite information from the Grand Rapids experiment, started in January, 1945, is expected in 1949. In January of this year Midland, Mich., also started adding 1 ppm. of fluorine. Annual costs of this type of treatment in the two places have been shown to be about $0.075 per person.

Experiments have shown that fluorine should be added to water immediately prior to filtration.

Although both speakers stressed that the projects are in the experimental stage, discussion of the two talks brought out the fact that fluorine is now being added to water supplies in Newburgh, N. Y.; Grand Rapids and Midland, Mich.; Brantford, Ontario; Sheboygan, Wis.; Ottawa, Kansas; and Marshall, Tex. In addition, fluorinization is being practiced at the State Training School at Southbury, Conn. Madison, Wis., has been considering it for some time, but as yet no action has been taken.

Housing and the Sanitary Engineer

***Editor's Note**—The ideal house should present an environment that contains no design or structural defects that in any way might adversely affect the health of any of its occupants. Although this is an unattainable "dream" at the present time, in the opinion of Prof. M. A. Pond of Yale University, there are many corrective measures that could be instituted by utilizing the talents of the sanitary engineer in housing. Drawing upon his experiences during the war when he was assigned by the U. S. Public Health Service to aid in the development of housing projects, Professor Pond outlined the following ideas before a recent meeting of the American Society of Civil Engineers.*

DURING the past decade a broadened concept of sanitary engineering has become widely accepted. No longer do sanitary engineers restrict their interest to water supply and sewage disposal, milk and food sanitation. Housing, probably more than any other field, embodies the range of interests that are included in modern sanitary engineering practice. This was the conclusion reached by M. Allen Pond, assistant professor of public health, Yale University, who addressed a recent meeting of the American Society of Civil Engineers in New York.

Housing developments, stated Professor Pond, involve at least four inter-related steps: (1) site selection; (2) site planning; (3) structural design, and (4) construction. Given the opportunity, the sanitary engineer makes his greatest single contribution to the healthfulness of housing when the site is selected. He also may be influential at the site planning stage. Largely because of inexperience, sanitary engineers have not yet played significant parts in house design and construction.

Attention to the site

Selection of sites for new housing, he said, has been tragically haphazard. Peripheral slums, and vacant subdivisions and blighted areas stand as mute evidence of unintelligent site selection. Some of the failures are attributable to a lack of competent appraisal of sanitation problems that would be encountered during development.

Site planning of a residential community is not highly developed and presents several problems for the sanitary engineer, the most important of which involve provision for water supply and sewage disposal. Although traditional practice in these is fundamentally sound, there is a need for further study of the economics of both in so far as housing is concerned. For example, there is a sharp division of opinion as to the feasibility of reusing existing subsurface utilities for new structures on cleared slum sites. Adherence to existing sewerage patterns may seriously embarrass the site plan and may increase construction costs. Furthermore, increased population density on carefully planned slum clearance projects may result in overloading existing sewers.

Environmental nuisances, such as heavily polluted streams, unsafe bodies of water, cliffs and other topographic hazards may be present on or adjacent to a site. Morbidity and

mortality statistics reveal that children are frequently struck down by accident while playing in hazardous areas. Effective planning of housing sites can result in the elimination or control of many environmental hazards.

Atmospheric pollution control has received increasing attention during recent years. If there are alternatives, home sites should not be selected in areas where smoke, fog or noxious fumes and odors are continuing nuisances. In planning plots that are subject to atmospheric pollution, advantage should be taken of topographic barriers, prevailing winds, and the orientation of structures as possible control measures.

Construction and sanitation

The sanitary engineering problems associated with the construction of housing are detailed and specific. To date, relatively few sanitary engineers have had housing construction experience and it is unlikely that many will become intimately associated with home builders until there is a greater appreciation of the numerous aspects of housing that are of sanitary significance. The U. S. Public Health Service engineers on field duty with the Federal Public Housing Administration have demonstrated the value of close liason with the building industry.

The following discussion of some of the sanitary engineering aspects of housing construction is illustrative but incomplete.

Water Lines—Specifications for the installation of new water mains usually contain a requirement that the distribution system be chlorinated and flushed prior to use for domestic purposes. Such clauses often are honored in the breach unless the responsible health authority or sanitary engineer supervises the work. More frequent use of the laboratory to determine the effectiveness of sterilization procedures is indicated. Indeed, modern specifications include a requirement that samples taken after the main has been chlorinated and flushed shall meet U. S. Public Health Service drinking water standards.

Rodent and Insect Control—Relatively few new houses are rat-proof although the cost of such protection is significantly less during construction than at any time thereafter. In communities where plague or typhus fever are endemic, all new dwellings should be built to exclude rodents.

The migration of domestic insect pests between dwelling units of multiple family housing frequent assumes serious proportions. The main traveled routes are along water, heating, power and drain lines. The sealing of annular openings around piping, passing through party walls, may be expected to reduce the frequency of cross infestation. As in rat-proofing, the success of pest control measures depends to a large extent on construction methods.

Inspection—There is an acute need for more frequent inspection by sanitary engineers in the development of housing sites. It is redundant to point out that a properly designed structure or utility can be distorted seriously during construction. As much care is needed in laying sewers as in designing them.

Changes in design standards

Sanitary engineering aspects of the design of houses are not clearcut, probably because there is so little factual information regarding what constitutes a healthful house. Current standards for illumination, heating, ventilation, plumbing, materials of construction and physical layout are largely based on opinion. Unfortunately, there has been little research to reveal facts necessary to strengthen existing standards.

An example of the chaos that exists in housing design standards is to be found in codes and other public requirements for illumination. It is well known that recommended lighting intensities have been doubled and in some cases trebled during the last decade. Yet there have been no valid data to support the need for the high intensity now recommended for households.

Plumbing standards have been subject to some inquiry and much discussion during recent years. The "Emergency Plumbing Standards for Defense Housing" first issue in February, 1942, by the Office of Emergency Management, Washington, D. C., were based on sensible public health practice. Several hundred thousand dwelling units were equipped with plumbing installed in accordance with these standards. Except for minor problems associated with the use of plastics for fixtures, there were no known serious difficulties resulting from the continuing use of these plumbing systems. There have been no records of cases of disease traceable to household plumbing installed in accordance with these standards. The life expectancy of such plumbing, of course, is unknown. Nevertheless, there is a serious need for the scaling down of existing standard plumbing codes to the point where they will be more realistic.

Sanitary engineers should not neglect the opportunity of studying and working on the design of dwellings. Their training and experience, if brought to focus on these problems, should help materially in bringing order out of the present chaos.

Modernization of regulations

Modernization of local housing regulations is overdue in most communities. Although building codes are periodically amended, revisions of housing ordinances and regulations are made infrequently, and many of the laws are outmoded. Study of the existing body of law in the light of housing survey findings is effective in discovering shortcomings. Furthermore, it provides a basis for drafting realistic amendments.

Much of the rehabilitation of existing structures involves the improvement of water supply, plumbing and sewage disposal facilities. The exercise of sound judgment by administrative officials is essential if property owners are forced to make betterments. In any ambitious enforcement program, the health department engineer might be expected to devote a considerable part of his time in reviewing findings and advising the administrator on courses of action.

Health department review of plans for new construction or alterations is uncommon. In the future, it may be expected that health officials will pay greater attention to this important service.

There are three paths in the housing field down which sanitary engineers may be expected to go: (1) research; (2) design and construction; and (3) administration. Each affords the opportunity of stimulating work and exercise of the imagination.

The research needs in the hygiene of housing have been listed formally

by various groups, and many of the problems are of a sanitary engineering nature. Top priority would in all likelihood be assigned to studies of domestic sewage disposal methods. Also high on the list would be original investigation into new techniques for household refuse disposal. Research on plumbing may be expected but routine application of any findings that tend to simplify present installations cannot be predicted with confidence. Studies of illumination, ventilation, heating and noise control, while of interest to sanitary engineers, are likely to be carried out by other professional groups.

Sanitary engineers in private practice are likely to find increasing opportunity for employment on the design and construction of group housing. As consultants to architects, planners and builders, this group can be immeasurably useful in improving the quality and livability of new housing through the application of tested, scientific methods. Although the sanitary engineering job to be done at any one housing development may be small in comparison with municipal sanitation projects, the aggregate of work in connection with the anticipated national housing program will be tremendous.

Finally, sanitary engineers in public service, particularly those in health departments, will be called upon increasingly to participate in the replanning of communities and in the solution of existing housing problems. During the past decade great strides have been taken by some city health officials toward a solution of the problem of blighted slums. Almost without exception this work has occurred in cities where sanitary engineers are employed in the health department.

What the sanitary engineers does and how he does it will depend on his interest and imagination, concluded professor Pond.

Boron in Los Angeles Water Supply Under Scrutiny Because of Court Action

Studies of the boron content in water from the Los Angeles (Owens River) Aqueduct, which have been under way for some 20 years, recently have been brought into focus by court action concerning disposal of the high-content boron water near its source. Because of the court action this disposal method, which was used with apparent success for the last decade to keep boron concentration in the water supply below objectionable levels, is not now available for use. Early solution to these legal problems is hoped for.

The long-time studies have been carried on cooperatively by the Los Angeles Department of Water and Power and the U. S. Bureau of Plant Industry, chiefly at the Department of Agriculture's Rubidoux Laboratory, Riverside, Calif. L. V. Wilcox, of that laboratory, is the author of a recent report entitled "Boron in the Los Angeles (Owens River) Aqueduct" which is abstracted in the following. A comprehensive outline of the problem up to that date appeared in *ENR* July 18, 1940, vol. p. 113.

About 20 years ago when injury to citrus trees in the San Fernando Valley due to boron became of significant proportions, it was noted that the injury appeared to be more severe in citrus groves irrigated with water from the Los Angeles Aqueduct than in groves supplied with water from local wells. As a result of these observations, a research project was set up to study the boron concentration in waters used for irrigation in this area and, in particular, in the water of the Los Angeles Aqueduct. The objective of this project was ". . . to determine the quantity and character of dissolved salts, including boron, in the aqueduct water in comparison with the underground waters . . ."

Several sampling sites were selected and observations have been made at two of these continuously since the summer of 1928. At the intake of the aqueduct on the Owens River near Aberdeen, Calif., 341 samples have been examined since 1928. Quantities of boron in excess of 1 ppm. occurred 42 times with the most recent occurrence in November, 1945 (a boron concentration of about 1 ppm. is considered to be harmful to citrus trees).

At the other sampling point where continuous studies have been made, the San Fernando power plant near the end of the aqueduct, 347 samples were analyzed and boron concentrations in excess of 1 ppm. occurred only seven times with the latest occurrence in 1934. The absence of high concentrations at this point for 12 years may, according to Mr. Wilcox, be related to management practices followed in operating the aqueduct. For a number of years prior to 1943, flood waters of high boron concentration were wasted into Owens Lake. By eliminating these contaminated waters the mean concentration was kept at a fairly low level.

Boron-water bypassed

Reduction of boron content by wasting flood waters may be explained by the presence of boron in a large area of marshy land some miles above the aqueduct intake. This area contains many hot springs. Some of the water from these springs discharges into the Owens River but much of it evaporates, leaving a deposit of salt containing boron on the soil. Heavy rains flush this salt residue into the river, causing an abrupt increase in total salinity as well as in boron. The total quantity of boron entering the aqueduct from this marshy area is not known but it is assumed to be large. This area is thought to be one of the two chief sources of boron in the aqueduct.

Bypassing abandoned

The bypassing of surplus flood waters to Owens Lake has kept the boron content in a safe range for a number of years. This practice was discontinued in 1944 as the result of court action. The effect of this change in operation of the aqueduct on the boron concentration is not yet apparent. However, it may not become noticeable because the importation of water from Mono Basin into the head waters of Owens River and the completion of the large storage reservoir in Long Valley have increased the quantity of water carried by the aqueduct. This increase may, by dilution, keep the proportion of boron to below objectionable limits.

Jungle Surveys for Oil Exploration

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Editor's Note—The search for oil in Eastern Venezuela calls for surveys in the virtually unexplored territory of the Delta Amacura. Among other things these surveys form the basis for mapping concession parcels, the concessionaire being required to furnish detailed maps to the Venezuelan government in order to legally exercise his rights. Recent work in this area is described by Mr. Charles, whose company was engaged on a contract with The Richmond Exploration Co.

EXPERIENCE gained from making surveys of The Delta Amacuro territory of Venezuela, in areas where high-order control heretofore was considered impractical, reveals that such work can be done with accuracy and economy. The methods involve the use of light-weight instruments and the erection of sturdy platforms in the streams that meander through the delta country.

As a matter of background it should be related that surveys in these isolated areas are carried out for: (1) exploration purposes to establish the limits of the concession conforming to national laws as well as for geophysical control; and (2) for exploitation purposes, which include the parcelation areas (usually limited in size) to be further tested or drilled. These parcels must be located and monumented and the description and plans presented to the Venezuelan government.

Some of these concessions contain hundreds of thousands of acres so that in size alone they present special problems to the surveyors. In addition, the terrain is such as to offer many obstacles to a rapid and accurate traverse.

Briefly described, the territory of Delta Amacuro is a vast low-lying area north of the Orinoco River. It is composed of mangrove swamps in the coastal reaches that are inundated at high tides. Mangrove growths are particularly thick along the tributary rivers and canos (cano being the local name for streams either silt or non-silt bearing). However, much of the area between these canos is savannah marshland, which is generally covered with from ten to thirty inches of water.

The delta region is quite rich in flora and fauna of rather unusual species. Birdlife is a screaming flamboyant movement from dawn to dusk. Animal life is as varied and abundant as the birdlife, but it is seldom seen. Throughout the delta there are orchids, hundreds of species, in a variety of colors and sizes. And there are hordes of insects, including mosquitos, gnats and large flies, the bite of the latter being quite painful.

Approaching the upper limit of tidal runs the mangrove swamps begin to disappear and they are replaced by tropical rain forests with heavy underbrush. Finally, at the headwaters of these streams there are prolific growths of water hyacinth; during flood season they break loose to form floating islands that extend for miles and completely clog the downstream waterways.

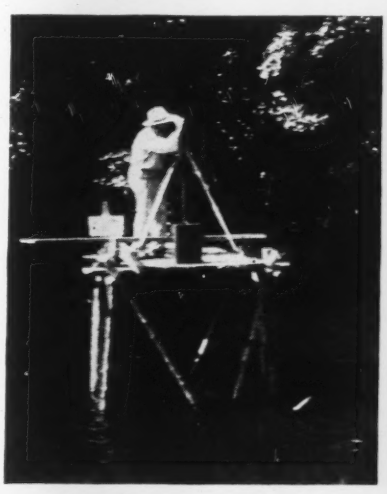


Fig. 1. Instrument platform in the waterway provided opportunities for taking long "shots" in the mangrove swamp region.

Normal survey methods out

Obviously normal survey methods, in the delta area cannot be used except at a prohibitive cost, new methods had to be devised. Since the waterways afforded the most direct route to a given point it was decided to use them in conjunction with a series of instrument platforms. The latter consisted of four bearing piles (placed by hand) with sufficient sway bracing to provide a fairly stable set-up. Planks were nailed across the frame to form a walkway for the instrument man.

The narrow canos are quite deep, and this made it desirable to locate the platforms near or on the shoreline. This in turn necessitated a rather large amount of "pica" or sight-line cutting, particularly on the inside of curves.

The width of the canos varied from 30 ft. to over 3,000 ft. and to a certain extent this width determined the method of line progress. In the very narrow canos we used a single stadia line, with 20 or 30 sec. instruments and 4-meter boards reading up to 1,200 ft. per course. The angles were doubled, and both foresight and backsight readings on distance were recorded.

It was extremely difficult to run some of these stadia lines because the jungle with its dark color and alternate sunlight and shadows provided a poor background for the stadia boards and here the light-gathering power of an instrument was very important.

Several advantages were found in

Fig. 2. A large part of the Delta Amacuro territory, which is on the eastern coast of Venezuela, is said to be virtually unexplored. Through it flows the Orinoco River, which traverses some 1,700 miles of the country.

Fig. 3. Typical conditions in the rain-forest area. At this point, some 40 miles inland, there was a 5 ft. tide change.

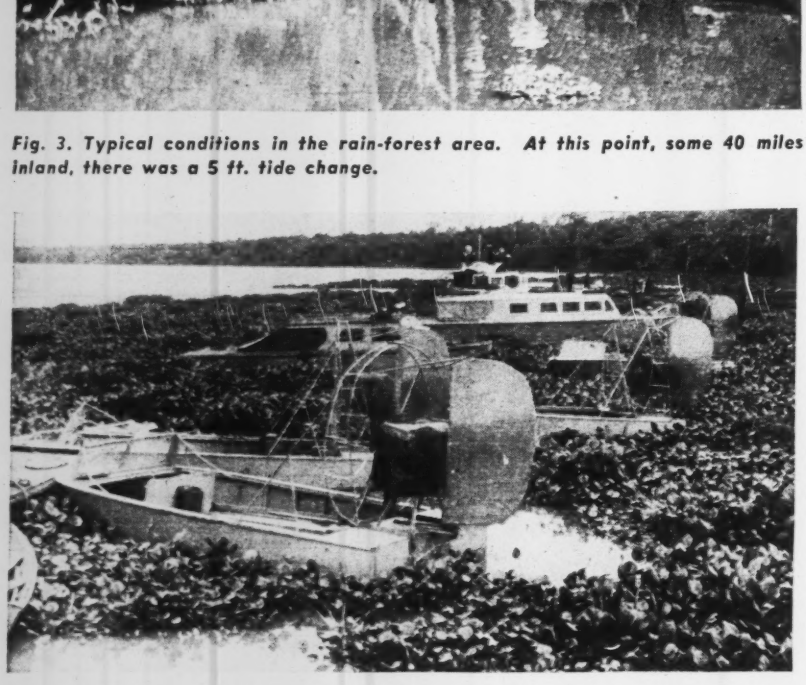


Fig. 4. Prolific growths of water hyacinths contribute to the difficulties encountered on surveys in the upper reaches of the "canos." Air-propelled boats (foreground) with their shallow draft are of great aid in reaching swamp areas.

staggering the platforms on alternate sides of the streams. This reduced sight-line cutting and therefore cost. Also, it was possible to "fix" the width of the canos as a topographic feature. Side shots were taken on the mouths of intersecting canos, on Indian huts and other features deemed necessary to the survey. The accuracy of these stadia lines averaged about 1:1,200, which was within the limits of accuracy required by the Venezuelan government on filed maps for such inaccessible regions.

When the width of canos was such that a quadrilateral with sides exceeding 1,100 ft. could be laid-out then that method was used to extend the lines. In the very large canos some of these quadrilaterals had sides 5,000 ft. in length. These quadrilaterals usually started from a measured baseline, or from known coordinate points, and wherever the terrain permitted a side was chained to check the calculations. The angles were turned four times with 20-sec. instruments or eight times with transits of lesser accuracy. All horizons were closed and the chain was calculated by the "sum of least squares" method. It was not unusual to obtain accuracy within the limits of from 1:2,500 to 1:3,000. At intervals a sun or star shot was taken for azimuth checks.

An improved technique

In this type of country a very practical method for producing line would be the horizontal invar bar and a one-second light-weight optical instrument such as the Wilde T-2. By using this method considerable distance per course could be gained, for example, in narrow canos where the platforms could be spaced up to 3,300 ft. or from curve to curve of the stream thereby eliminating a costly amount of platform construction as well as decreasing the time and therefore the overall cost of running the line.

The invar bars should have large bright targets at their ends and some sighting arrangement should be used that would enable the rodman to place the bar perpendicular to the line-of-sight. The angles should be doubled, of course, to check the observer, although the first reading will be to one second. With such equipment it is possible to produce line under adverse conditions to accuracies in excess of 1:5,000.

Where large-scale triangulation was undertaken—across bays or large canos mouths or along the shore in surf—the advantage of the light, fast one-second instruments was readily apparent. Generally observations in these cases had to be made under poor conditions and speed was of prime importance.

Ground control by radar

Use of radar-type instruments to establish ground and topographic control in these inaccessible areas will eliminate much of the expense now incurred for survey lines run on the ground.

From a series of baselines run by the platform method and using high-degree "fixes" as beginning coordinates it will be possible to adequately survey by radar "fixes" all necessary topographical features such as watercourses and shorelines as well as establish actual coordinate points including concession corners and drill sites.

While it is not possible to give here any actual figures on the accuracy of such surveys all available information indicates that the accuracies are well above those normally specified for exploration and exploitation surveys.

However, a certain amount of ground control is necessary prior to the radar application, and in areas similar to the delta these would probably be established by the platform method. The writer's experience indicates that by using a light power-hammer and slightly longer and heavier piling the platforms could be set in deep water thereby reducing the very costly sight-line cutting and trimming. Furthermore the greater stability of the platforms permits the establishment of baselines the accuracy of which, heretofore, has been considered impractical in these regions. With the installation of radar units at the extremities of such a baseline it would be possible by using a third portable unit to obtain coordinate "fixes" throughout the workable arc. A second or third baseline established to carry on from the first should not only permit "fixes" for corners and boundaries but would also include other topographical features.

Initial cost of this type of equipment would be only slightly higher than would be the cost of conventional equipment, but the progress achieved with the aid of radar equipment would mean a tremendous saving in overall costs.

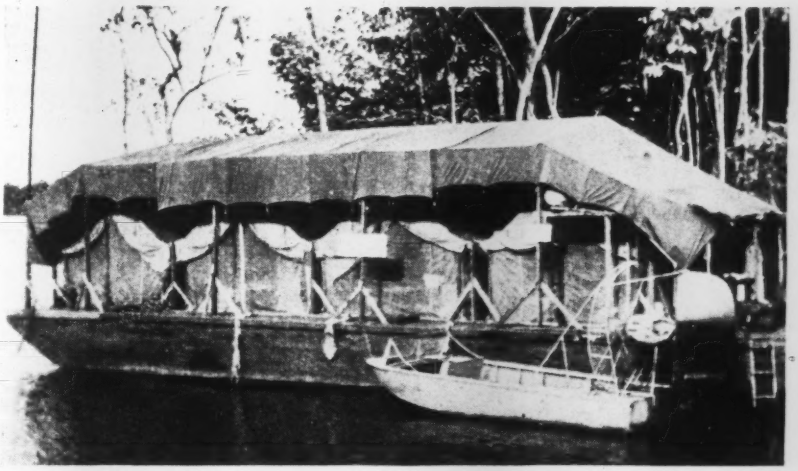


Fig. 5. Floating camps used by the 8-man survey crews. Mounted on a barge were four tents and such facilities as showers, refrigerators, radio equipment and a small electric-power plant.

Another method for the survey of large unexplored areas would be the use of aerial photography. But here again a certain amount of ground control is necessary, and to date the accuracies of aerial photography are limited.

Equipment and personnel

In the delta survey the only means of transportation was by water. Instrumentmen moved from set-up to set-up using a Higgins boat or native dugout. Supplies were carried by water and boats were the only means of maintaining communication in some cases.

The importance of radio service between these isolated field parties cannot be stressed enough, since some of the field parties were as much as eight hours run by Higgins (12-15 knots) from the main camp.

Under these conditions proper supervision and careful planning are of prime importance if the work is to progress without too much lost time. Furthermore, all equipment must be selected for good performance under humid conditions, and should be as rugged as possible because repair facilities generally are hundreds of miles distant.

Personnel for such survey operations need to be carefully selected, keeping in mind that these men will have to live with themselves and a native crew—utterly isolated from the world and creature comforts — for long periods of time. On their adaptability to these conditions and on their ability to make decisions hinges much of the success of the operation.

Detroit Hopes to Finance Long-Range Program

Detroit plans to spend $500 million on municipal improvements during the next generation, with the emphasis on a new traffic network and playgrounds, according to the American Public Works Association.

The Detroit Planning Commission has devised a public works improvement schedule calling for expenditure of $15 million a year for six years starting in 1947. More than $10 million will be spent for new sewers this year.

By 1970, if present plans are carried out, Detroit will have spent $295 million for a new system of streets and expressways, $90 million for recreation centers, parks, and stadiums, and $55 million for a civic center.

Most of Detroit's capital improvement during the next few years is to be accomplished on the "pay-as-you-go" plan—without public borrowing. The city has been reducing its debt since 1941 to make this possible. Since Pearl Harbor, Detroit's debt has been lowered 19 per cent—from $329 to $267 million.

Diesel Pile Hammers Used by Germans

Mc-Graw-Hill World News
Berlin Bureau

***Contents in Brief**—Diesel pile-driving hammers in two designs and several sizes, with special driving rigs, were developed and used by German military engineers in World War II. Low total weight and small fuel consumption made the equipment especially valuable for military needs and point to possible peacetime use. The hammers are single-acting, depending on the blow to compress and ignite fuel, which produces an explosion sufficient to raise the ram for the next gravity stroke.*

As part of the program of studying developments made by the Germans during the war years to determine what contribution they might make to American industrial development, diesel pile-driving hammers and portable rigs to handle them, developed by the Germans for military use, were searched out, studied and used by the U. S. 33rd Engineers, Special Service Regiment, Col. Heath Twichell, commanding. The hammers are single-acting, using the diesel explosion to lift the ram for a free gravity fall for driving.

Fig. 1. Diesel hammer used under direction of U. S. Army Engineers in construction of a bridge on the Autobahn over the Neckar River near Mannheim, Germany. Piles are 16-in. dia. pipe, 45 ft. long.

Two types of hammers were found that had been used by the German military engineers. The "Schlagzerstauber" (hit atomizer), abbreviated to SZ, is made in two sizes; 500 kg. (1,100 lb.) ram, and 1,250 kg. (2,760 lb.) ram. These hammers were manufactured by the Delmag Machine Co. in Esslingen, Germany, and have an enclosed piston that serves as the ram.

The "Diesel-bar," DB, hammers were manufactured by Menck and Hambrock in Hamburg in three sizes: 600 kg. (1,320 lb.) ram, 1,200 kg. (2,660 lb.) and 1,800 kg. (3,980 lb.). The DB hammers, Fig. 1, have a guided ram falling in the open on an explosition mechanism that forces the return. Special leads for each of the types of hammers are designed for ease in moving and for erecting and driving without the aid of other equipment.

Exposed ram hammers

In the DB type hammers the ram, operating as a two cycle engine, moves on vertical guides and falls free onto a stationary piston that fits into a cylinder in the ram where the lifting explosion takes place, Fig. 3. The hammer cycle is started by lifting the ram by external means. As the ram falls, the piston confines the air in the cylinder of the ram and starts compression. The cam of a fuel injection pump is actuated by the ram and is forced against a spring-loaded piston, which is forced down to close the fuel intake lines from the tank and compress the fuel against the spring-cushioned shut-off valve. When sufficient force is applied by the fluid against the face of the shut-off valve it opens and fuel is pushed out of a jet in the head of the piston to the cylinder of the ram.

DATA ON DB TYPE DIESEL PILE HAMMERS

	DB 600	DB 1200	DB 1800
Weight of ram—lb.	1,320	2,660	3,980
Diesel fuel per hr.—gal.	1.6	2.2	2.6
Lubricant per hr.—gal.	¼	¼	¼
Dia. of blow plate—in.	17.3	20.4	23.6
Overall length—ft.	9.0	9.8	10.6
Total weight—lb.	5,500	7,700	10,000
Capacity of pile—tons	26.5	55	55

Still falling, the ram in its compression stroke creates sufficient heat and pressure to ignite the atomized fuel just as the ram seat strikes the anvil assembly. Combustion in the highly compressed air generates sufficient pressure to force the ram back to the starting position; exhaust gases are exchanged for fresh air and the hammer is ready to repeat the cycle.

Specially designed feet of the ram strike the anvil block assembly at the lower end and the blow is transmitted through the pile-driving cap to the pile. Thus the lower stop bracket—of which the piston, fuel tank, fuel-injection pump and fuel-supply control valve are integral parts—receives little shock from the blow.

On the DB hammer the amount of fuel entering the cylinder is governed by varying the length of stroke of the fuel-injection pump piston by manipulating a chain-controlled lever from the ground. Decreasing the amount of fuel forced into the explosion chamber decreases the height to which the ram is raised for the succeeding gravity stroke.

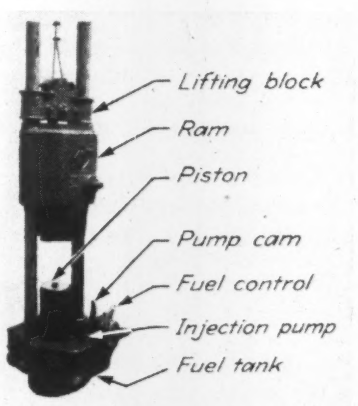


Fig. 3. In the DB type hammer an open cylinder in the ram falls on a fixed piston to compress air into which atomized fuel is forced by action of the ram falling on the injection pump cam. Explosion of the fuel raises the ram for the next gravity stroke.

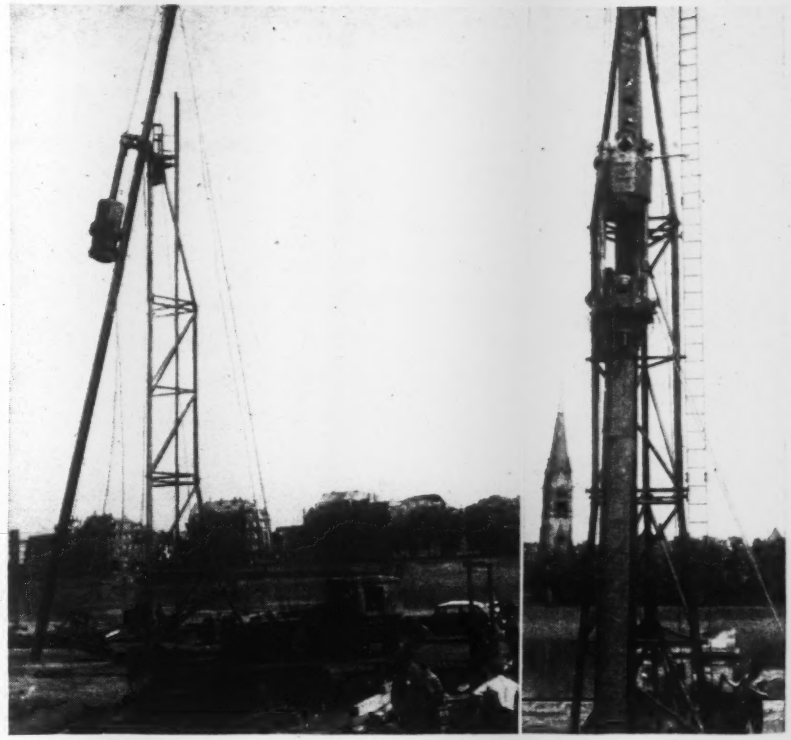


Fig. 2. Screw luffing of boom permits sufficient movement for 1:3 batter to the front or 1:6 batter backward. At right, hammer is shown with the ram pulled to starting position for driving a pile.

The DB hammer strikes an average of 50 blows per minute and has a length of fall of ram varying from 3.3 to 4.6 ft. Data concerning the DB hammers are given in an accompanying table. The driving formula used for the DB 1800, (3,980-lb. ram) hammer is $P = \frac{198}{e+1}$ in which P is the bearing capacity of the pile in tons and e is the penetration in centimeters of the last 30 blows of the hammer.

Powered portable driver

The rig developed by the Germans for handling the DB 1800 hammer is shown in Fig. 1 in use on the Autobahn Bridge over the Neckar River near Mannheim, Germany. This rig is turntable-mounted on a base that moves on rails on double flanged wheels.

A 24-kw. generator on the rear of the turntable provides power for an electric motor that drives a hoist to power all units of the driving rig. Drums are provided for a hammer line, a pile line and for an erection line. In addition, power from the same hoist moves the rig along on rails. Screw luffing of the boom is accomplished through a bevel gear on the erection-line drum shaft.

The three-section boom of tubular frame design is erected by pulling up over an A-frame. A 65-ft. long box-section hammer guide is hinged to the top of the boom and at the bottom is rigged in such a way that driving piles with forward, back or side batter can be readily accomplished. Special fittings are used to attach the hammer to the guide.

To start driving operations, the hammer unit is pulled up the guide to the height necessary to set a pile. The ram lifting-block in the hammer frame above the ram is lowered to engage the ram unit, which is lifted to the top of the hammer frame. A line to the ground permits releasing the ram to start the hammer cycle. Operation of the hammer is stopped by shutting off the fuel supply.

The rig described, (Fig. 2) is capable of driving piles up to about 50

ft. long with a weight up to 3½ tons. Total weight of the driving rig and hammer is 15 tons. The driving rig also can be used as a crane by removal of the hammer and guides. For this use the pile line is reeved through a pulley at the top of the boom and can handle 2 tons at 45 ft. radius or 8 tons at 14 ft. radius.

Pipe cylinder encloses SZ ram

The SZ hammers also operate as a two-cycle engine with the ram working up and down as a piston in a steel pipe that serves as the engine cylinder. The falling ram strikes a blow-plate (Fig. 4) that acts as a short anvil block hitting the piles to be driven, and protecting the steel pipe and engine cylinder from excessive shock. A fuel pump is bolted to the cylinder in such a position that a cam forces the pump lever down against a spring cushioned piston. This in turn closes the supply line of the fuel tank and builds up the pressure of the oil against the shut-off valve.

A measured amount of fuel is admitted to the cylinder where it is compressed by the downward stroke of the piston, which also closes the intake port. The ram strikes the blow-plate causing the fuel in the pan to be atomized and burned in the highly compressed air. The expanding gas forces the ram up, allowing the exhaust gases to escape through the open port and returning the piston to start another cycle. The force of the blows is regulated through by-passing part of the fuel back into the fuel tank, thus reducing the power of the explosion and lifting the hammer a shorter distance. The fuel supply control valve is manipulated from the ground through a chain, the ends of which are fastened to the lever arms of the valve.

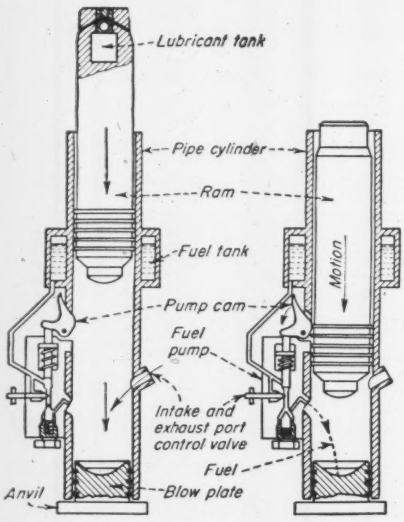


Fig. 4. The ram acts as a piston in the SZ hammer and in falling moves a cam that forces fuel into the "blowplate" where it is ignited under compression. The resulting explosion raises the piston for the next gravity stroke.

The fuel tank is welded around the steel pipe cylinder in the form of a horseshoe so that there is no interference with a hammer guide provided for attachment to special leads. The piston is automatically lubricated by the shock of the blows spilling oil from the lubricant tank in the head of the ram.

The diesel cycle is started by lifting the piston to the top of the cylinder by mechanical means—a single drop starting the hammer to function. For use during cold weather a preheating pan is located around the cylinder just below the blow-plate.

The 500-kg. SZ hammer has a 13.7-in. dia. cylinder and a maximum fall of 6.56 ft. for its 1,100-lb. ram. It has an overall length of 10 ft. and a total weight of 2,000 lb. It makes an average of 50 blows per minute and consumes about 0.8 gal. of fuel oil and one pint of lubricating oil per working hour. It is said to drive piles successfully to a bearing capacity of more than 25 tons.

Manually handled rig

Designed for manual erection as well as manual handling of hammer and pile, a special rig for the smaller SZ hammers weighs a little more than a ton. The heaviest piece is a double-drum winch weighing about 500 lb.

A collapsible triangular base frame is equipped with wheels to make it locally movable and is set up with the winch at the opposite side from the hammer to serve as part of the counterweight. The hammer guide or boom is a triangular tubular mast as are two stiff-legs that brace it on the triangular bottom frame. The long hammer guide is erected by use of a short temporary mast that gives the winch a better advantage in raising the hammer guide into position. The assembled rig, Fig. 5, will handle piles some 30 ft. long weighing as much as a ton.

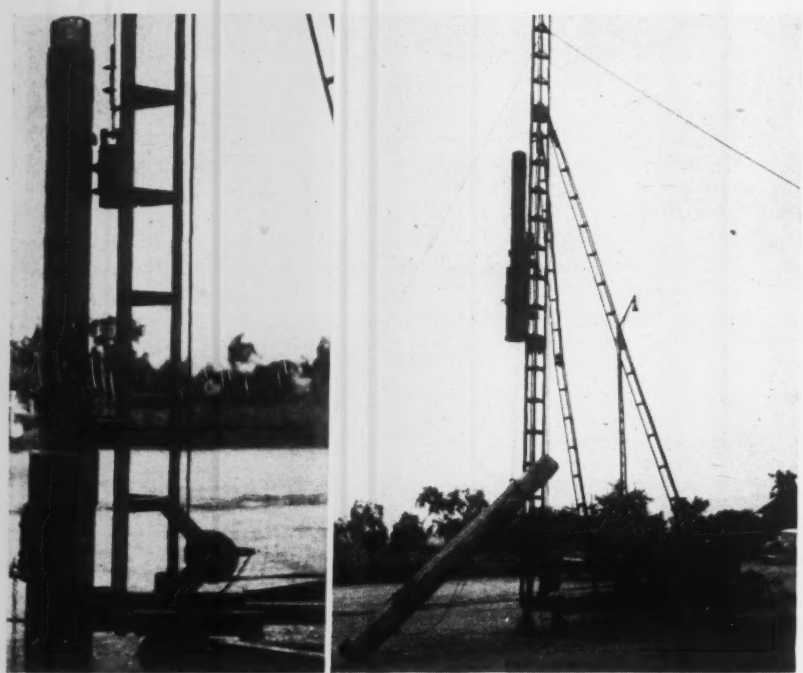


Fig. 5. The SZ hammer is fastened to the leads by bolted members. A special dog engages the piston to lift it to start the diesel cycle. At right, one line on the hand winch is used to hold the hammer while another picks up a pile. Chains from the hammer to the ground are used to control the fuel valve.

Steel Forms Speed Construction Of Long Bridge Approach

***Contents in Brief**—Construction of a South Carolina highway bridge was expedited by the use of steel forms for the piles, caps, and deck of the long reinforced-concrete approach required. Deck forms were made up in sections 18 in. wide and no special problems were encountered in their erection. Their use proved so satisfactory that at least three similar South Carolina bridges are being built with steel forms.*

SECTIONAL metal forms for concrete deck-girder spans proved more economical and progress was better than was estimated for other forming methods for a long approach to a highway bridge across the Pee Dee River on Route U. S. 76 in South Carolina. The new bridge has a total length of 5,287 ft. with a 26-ft. roadway designed for H15-S12 loading. A 2½-ft. sidewalk is provided on each side of the bridge. The main channel crossing is a 572-ft., 5-span continuous plate girder unit with spans varying from 106 to 120 ft.

A long approach from the west is made up of 135 similar 30-ft. reinforced concrete deck-and-girder spans supported on 4-pile bents. The deck of the approach span consists of four lines of girders 13½ in. wide by 2 ft. deep placed integrally with a 6-¾ in. thick slab. On this approach structure use of steel forms proved so successful that they have been adopted for at least three other jobs in South Carolina. The forms were used for precasting piles, for forming pile caps and for pouring the deck in place. The forms are in small units to be readily handled manually and are put together with rapid type fasteners.

The area crossed by the long approach carries water only at flood time. This condition permitted construction of a haul road parallel to the approach, which greatly simplified and expedited the approach work. Bearing value of the sandy clay foundation soil is fairly high and four 18x18-in. concrete piles with an average length of 45 ft. were found adequate for each bent of the approach.

The contractor cast the piles at the site in forms moved ahead from bent to bent as work advanced eliminating the need for hauling. The forms were made up with metal sides and timber bottoms. Twelve sets were available to meet the driving schedule.

A concrete designed for a maximum slump of 2½ in. and a minimum strength of 4,000 psi. at 28 days was used for the piles and the deck alike. The mix called for 94 lb. of cement, 165 lb. of sand, 360 lb. of crushed granite aggregate, and 48 to 50 lb. of water. In casting the piles, low-heat cement was used to avoid the creation of high stresses within the pile due to the shrinkage of the concrete during curing.

A single-acting steam hammer with a 5,000-lb. ram was used to drive the piles. The hammer was handled by a 100-ton full-revolving crane that traveled forward along the center line of the bridge on timber mats.

In constructing the caps of the piles and the deck, high-early-strength cement was used to permit the stripping of the forms earlier than would have otherwise been possible. All the concrete was mixed with a 27-E single-drum paver that traveled along the haul road. The concrete was delivered from the mixer to the forms in a 1-yd. bottom-dump bucket handled by a crawler crane.

Forms supported on timbers

The greater portion of the forms for the pile caps and deck was made of 10-gage sheet steel. The side forms for the caps were generally made up in eight sections, two at either end, and two at each side. The center line joint between the end sections was designed to permit addition of a narrow piece to widen the forms a few inches, when necessary to meet a variation in the position of the pile heads. The bottom of these forms consisted of tongue and groove lumber over 2x6-in. transverse timber supported by two 6x6-in. timbers bolted together adjacent to each pile so as to

Fig. 1. The metal deck forms were made up in 18-in. wide sections and good alignment was possible.

be supported by friction. To provide more support, an additional set of timber friction supports was installed underneath the 6x6's at each bent.

Deck forms of all-welded design

Forms for the deck were made up in all-welded sections 18 in. wide (Fig. 3), except those for the diaphragms, which were 12 in. wide. In those spans where the length of the girders varied slightly, due to the use of wider bent caps to accommodate variation in the spacing of the piles, the end panels were made of lumber.

Sufficient sections of the forms were available for five spans of the deck, except for the sidewalk, for which panels were available for only two spans. A 21-in. I-beam was installed under each girder to support the deck forms, sufficient beams being available for ten spans.

The beams were supported from the pile caps as shown in Fig. 2. This method of suspension consisted of a double 8-in. channel on top of the cap at either side of each beam and a similar double channel under the end of the beam. To permit the beams on one side of the cap to be loaded differently from those in the neighboring span, 4-in. I-beams had to be inserted under the caps as shown. This arrangement permitted the $1\frac{1}{4}$-in. dia. bolts connecting the top and bottom channels to be drawn up to create a rigid support either side of the cap.

Fig. 2. Forms for the deck were supported on steel I-beams, one being used under each girder.

Wood strips of varying thickness to give the desired camber were placed on top of the steel beams. Next, joists were installed on about a 12-in. spacing. Most of the joists were 2x6's, but 4x6 or 6x6 in. timbers were added directly under the brackets for the sidewalks. Two pieces of nominal 2x8 in. $1\frac{3}{4}$-in. thick tongue-and-groove lumber were laid longitudinally on the joists directly over the I-beams to serve as the bottom of the forms for the $13\frac{1}{2}$-in wide girders.

Two methods were used in setting the steel forms for the deck into place. On some spans, about five sections were assembled end-to-end in a vertical position and set into place as a unit (Fig. 3). With the second method of assembly, the individual sections were set in place by two men working on the top while two men working on the scaffolding suspended from the steel beams joined the sections together. Progress was about the same with the two methods and each proved to have certain advantages. With both methods, small wooden wedges were used above the 2x6's to make local adjustment in alignment.

A light angle was provided along both edges of the sections of the forms. Small square pins passing through matching holes in the outstanding legs of these angles brought the adjoining sections into alignment. Small clamps fitting over the projecting legs held the sections together and assured a tight joint between sections (Fig. 3 right).

The cantilevered form for each sidewalk bracket was supported by a single small screw jack resting on the 6x6-in. joist. To provide a rigid support for the outer end of the timber, a diagonal brace bearing on the lower flange of the outer I-beam was installed, as illustrated in Fig. 4. The jacks permitted accurate "grading" and "regrading" of the bracket.

Between the brackets, the forms for the edge of the roadway were sup-

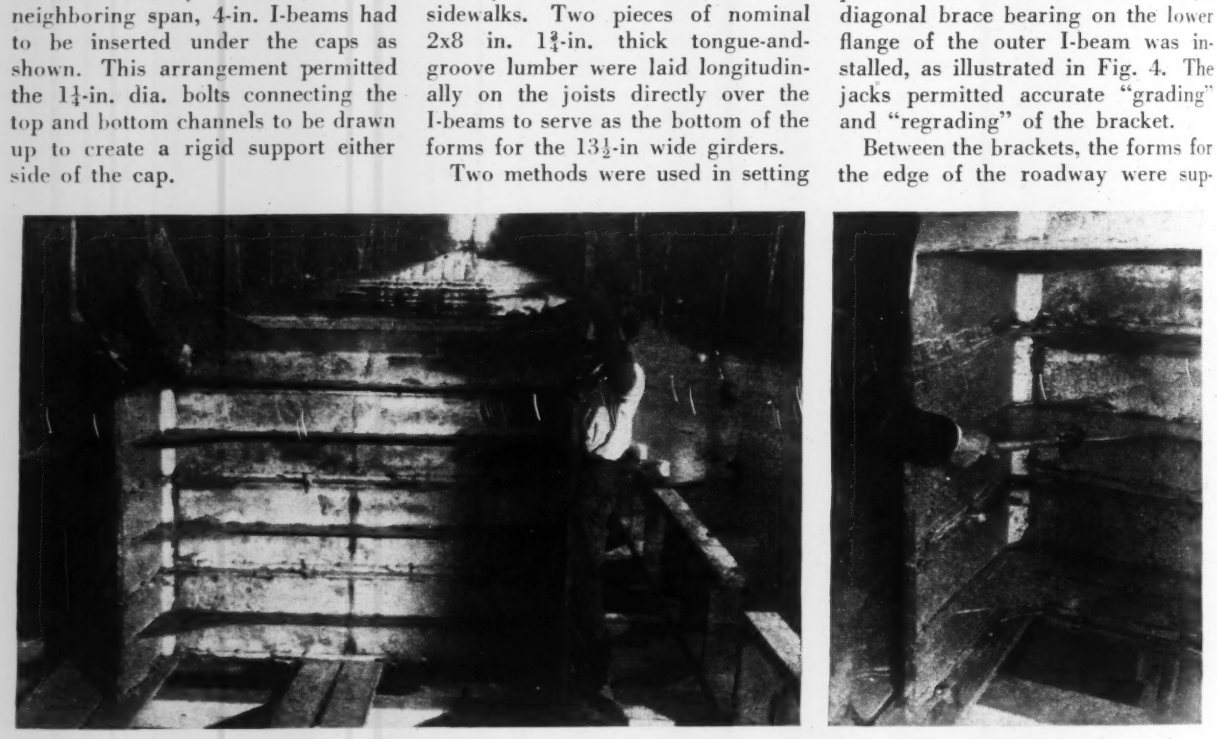


Fig. 3. In some spans, four or five sections of the deck forms were joined (left photo) and then placed as a unit. To bring the sections into alignment, pins were driven through the matching holes in the angle at the edges of the forms (right photo), and the sections clamped together.

Fig. 4. Forms for the sidewalk brackets were supported on small screw jacks on timbers braced with 4 x 4-in. diagonals extending downward to the lower flange of the steel beams.

Fig. 5. For leveling the concrete for the deck a steel screed with a ½-hp. vibrator mounted on it was employed.

ported on 2x8-in. posts bearing on a longitudinal 2x8-in. piece and being capped with a simlar member. The posts and the caps were made up in sections fitting between the brackets and the sections could be quickly removed, carried ahead, and assembled for a new span.

Finishing of the concrete for the deck was distinguished by use of a special steel screed with a ½-hp. gasoline-driven vibrator mounted above the screed (Fig. 5). This vibrator was attached to the screed by means of a 1-in. dia. steel pipe connecting the ends of the screed and in the shape of an A-frame. A strong coiled spring at either side of the engine provided adequate support and at the same time allowed the screed to vibrate.

In disassembly of the deck forms, the 18-in. wide sections resulted in no special problem as they could be sprung slightly by hand and readily removed. In contrast, on the first spans, some difficulty was encountered in removing the forms for the diaphragms. However, this problem was soon solved very effectively. A small hole was drilled through the bottom of the form near each end and a nut for a ½-in. dia. bolt was welded on the underside of the form at each hole. Short bolts were then screwed into the nuts with their upper ends flush with the inner face of the form. In removal of the forms, the short bolts were given a few turns, which quickly loosened the form panel and expedited its removal.

Construction of the sidewalks and railings followed a few days behind the roadway slab. Two 4x10-in. longitudinal timber stringers suspended between the previously cast brackets were used to support the sidewalk forms, this method of support being designed for quick assembly and disassembly. The ends of the 4x10-in. pieces rested on light steel channels connected by ¾-in. dia. bolts to similar channels placed over the brackets (Fig. 6). The nuts of the bolts were placed at the top and fixed so that they would not turn. Quick adjustment and disassembly of the forms was possible by turning the bolts from their lower ends. Above the 4x10-in. timbers, two heights of transverse 2x6's spaced on 21-in. centers were installed to support the metal pans for the underside of the sidewalks and the steel side forms.

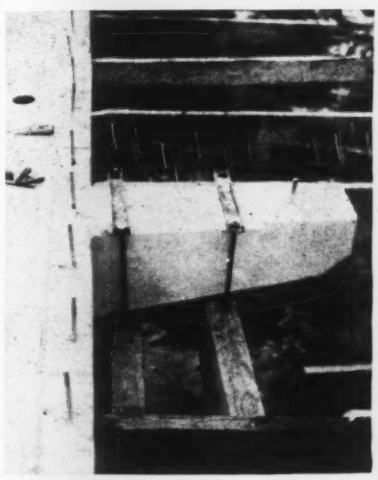


Fig. 6. To permit rapid disassembly, sidewalk forms were supported on two 4x10-in. timbers suspended from channels placed over the brackets.

One span completed daily

Following the methods outlined, a crew of 75 men, exclusive of the pile-driving crew, was able to complete one span of the approach daily, weather permitting. General practice was to place the concrete for only one span of the deck each day and schedule other operations to this pace.

The bridge was built by the South Carolina State Highway Department for which C. R. McMillan is state highway engineer, and W. J. Gooding, Jr., bridge engineer. On the job, A. T. Clarkson, was resident engineer.

C. Y. Thomason Co., Greenwood, S. C., for which Samuel Blackmon, Jr., was superintendent, built the long approach. Joseph W. Barnwell, Columbia, S. C., and D. M. Rickenbacker, Union, S. C., as a combination, built the substructure and placed the concrete deck for the plate girder spans. Nashville Bridge Co., Nashville, Tenn., had the contract for the steel superstructure of the girder spans. E. W. Grannis Co., Fayetteville, N. C., did the grading work.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Salvaging Old Pavements

Sir: The Dec. 19 issue of *ENR* carried on vol. p. 836 a short summary of a paper on bituminous resurfacing of concrete pavements which I presented at the December meeting of the Highway Research Board. This summary quoted me as saying: "that if 1.7 percent of the area of the pavement needs to be patched with concrete, the cost of that work will be about equal to the cost of resurfacing, hence resurfacing is indicated when that state has been reached." This particular statement is not an accurate quotation. What I actually said was, "The most economical time to apply a bituminous surface is at the time it is anticipated that *as an annual average*, 1 to 1.7 percent of the area would need to be patched with concrete if the road were to be maintained as a concrete pavement." It will be recognized that the phrase "as an annual average" establishes a somewhat different criterion than would be established were this phrase omitted as was done in the quotation in your magazine.

WAYNE R. WOOLLEY
Materials Engineer, Division Four, Public Roads Administration, Chicago, Ill.

Highway Costs

Sir: The article in the March 6 issue of *Engineering News-Record*, (Vol. p. 373) entitled "Missouri Analyzes Highway Job to Determine Costs", by Charles C. Tevis, assistant engineer of construction of the Missouri State Highway Department, was a dandy. Congratulations to *Engineering News-Record* for printing such a constructive article and also to Mr. Tevis for taking the time to be of service to highway engineers and highway contractors, as well as to the public. Ordinarily an article on such a subject is valueless because no account is taken of intangibles such as overhead supervision, part-time use of machinery, and many other items.

No city or state profits from low bids which break a contractor financially, and yet no one wants contractors to get rich on any one job.

Mr. Tevis' article should be of great value to the industry generally, informative as it is in this area as to what highway work costs during this present period of labor unrest and high material cost.

ROBERT B. BROOKS
Consulting Engineer
St. Louis 1, Mo.

Architects of Grand Central

Sir: The review of the book "Grand Central" in *ENR* Feb. 6, vol. p. 224, disappoints me, when I come upon such a statement as this: "The architects also come in for comment, but some of it is too complimentary to Whitney Warren, who is generally credited with having designed the architectural elements of the present structure."

The author of "Grand Central," David Marshall has established beyond dispute that my uncle Charles Aldrich Reed, and my father William J. Wilgus were chief architect and chief engineer respectively, and that though Warren and Wetmore endeavored to substitute their own design, the present structure is from the original plans as submitted by Reed and Stem. Mr. Marshall relates the excoriating rebuke of Justice Delehanty (July 1916) for Warren and Wetmore's "breach of trust in negotiating their new contract behind the backs of Reed and Stem, and at the very moment when Reed lay dying." He tells us that some time later "a Supreme Court referee declared Warren and Wetmore liable for more than $200,000 above and over the sum which their 'erroneous and improper' accounting showed to be due Stem and the Reed estate."

It was with gratitude that I read the long watched-for true story of the building of Grand Central wherein the names of Reed and Wilgus are restored to their proper eminence. [illegible] had grown up, so to speak, in the New York Central and constantly heard the entire drama.

Now for the first time Charles Reed and William J. Wilgus, who did so much in helping to build a segment of America, have come into their just rights. And this is owing to no disinterested justice on the part of the officials of the New York Central Railway, but rather to the factual researches and imaginative presentation of David Marshall.

WILLIAM J. WILGUS, Jr.
Millbrook, N. Y.

The important word "not" was left out of the sentence quoted by Mr. Wilgus in his first paragraph. It should have read: "The architects also come in for comment, but some of it is *not* too complimentary to Whitney Warren."—EDITORS.

Germans Destroy Dnieper

Sir: I was surprised to see on Vol. p 335 of *Engineering News-Record* for Feb. 27, 1947, the old myth bobbing up again that the generators at the Dnieper Dam "were destroyed (by the Russians) to prevent their use by the Germans."

Ever since my visit to Zaporozhe, site of the Dnieper Dam in the Ukraine, in 1944, I have tried hard to straighten out the record. The true story is that when the Russians retreated in 1941 they tried to render the nine generators unusable by short-circuiting them and removing some of the vital equipment. The Germans very soon were able to get the five American-made generators back in operation, but they were unable to restore the four of Russian manufacture.

It was the Germans, when they were driven out by the Russian counteroffensive of 1943, who demolished the generators, along with the power station and parts of the dam. I think the Russians were too proud of the Dnieper Dam, one of the crowning jewels of the first five-year plan, to inflict any thoroughgoing wrecking, and besides, they knew they were coming back. The Germans, on the contrary, knew when they were driven out they never were going back.

MAJ. GEN. PHILIP B. FLEMING
Administrator, Federal Works Agency

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Concrete Block Used For Canal Lining

As part of a program aimed at development of canal linings at lower costs, the Bureau of Reclamation is using precast concrete blocks to line a lateral on the Roza Division of the Yakima project in eastern Washington. In this work, which is illustrated by the accompanying photograph, the bureau is producing the blocks on a mass production basis at a central plant to make their cost as low as possible.

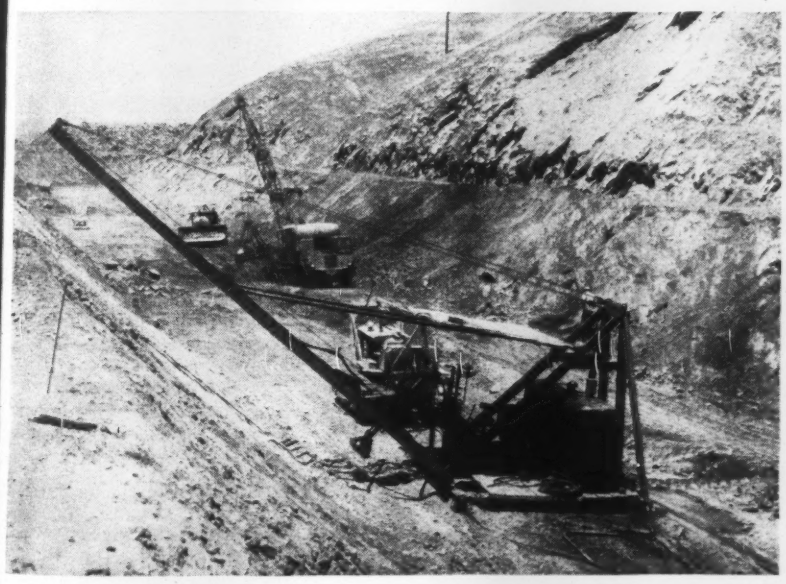
The blocks are being placed with unskilled labor and without the use of special equipment. The hope is that this type of lining will be found adaptable to smaller canals.

The work is being done as part of a research program aimed at studying various types of linings. The study will embrace a number of materials and numerous construction techniques, as described in detail in *ENR* Feb. 6, vol. p. 192.

A Bureau of Reclamation project to secure more economical canal linings includes use of concrete block for this lateral of the Yakima project.

Region I of the bureau, with offices at Boise, Idaho, is doing the work shown in the photograph above.

SPECIAL RIG REDUCES COST OF BACKFILLING OPERATIONS



In lining the Friant-Kern Canal this special rig permitted a cost saving on those sections where rock was encountered and over-excavation occurred. The rig was employed to compact the backfill material. The machine was built by the general contractor, the Peter Kiewit Sons' Co. It has an 18 x 28-in. compaction shoe and is powered by an air compressor of 310 cfm. capacity. The rig was pulled slowly ahead by a crawler tractor as work progressed. The Friant Kern Canal is part of the Bureau of Reclamation's Central Valley Project.

Deformed Bars Compared As to Resistance to Slip

Results of tests on 17 different designs of deformed reinforcing bars to determine their resistance to slip in concrete, reported by Arthur P. Clark in the *Journal of Research*, December, 1946, of the National Bureau of Standards, indicate that the height of deformations is an important factor in determining the effect of settlement of concrete under the bar. The pattern of the deformation does not seem to be important in determining bond value, but the inclination of the faces of the deformations is.

For test purposes, pull-out type specimens were cast in a horizontal position with varying embedment and depth of concrete under the bars. Slip at both the loaded and free ends were measured. In evaluating the efficiency of the bars in bond, the average performance was used for a range of slips as measured at the loaded and free ends for a bar with 2 in. and 15 in. of concrete under it and for 8-in. and 16-in. embedment.

The tests also indicated that a certain group of the bars were definitely superior to the others and bars cast in top position were less effective.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

For Waterworks Operators

LABORATORY CONTROL OF WATER PURIFICATION—By Charles R. Cox 386 pp. Case-Shepperd-Mann Publishing Co., New York, 18, N. Y. $4.00.

Geared directly to the needs of the practical water works operator, this manual provides readily understandable guidance for the solution of daily problems. Starting with basic rules of chemistry the author deals successively with all subdivisions of water purification control in logical and easy steps. The final chapters cover corrosion and bacteriology concisely and simply. Although this text is designed for the operator, busy engineers, who have forgotten once-studied laboratory techniques, will find it a handy reference to grasp quickly the chemical bases of the design of water treatment facilities.

Soil Mechanics Papers

CONTRIBUTIONS TO SOIL MECHANICS: 1925-1940—A reprint of papers before the Boston Society of Civil Engineers and the New England Water Works Association. 413 pp. Published by the Boston Society of Civil Engineers, 715 Tremont Temple, Boston, Mass. $2.25.

The year 1925 may be said to mark the beginning of active interest in the subject of soil mechanics in this country. It was in that year that *Engineering News-Record* published a series of articles setting forth in detail the principles developed by Karl Terzaghi, and it was in that year that Dr. Terzaghi came to Massachusetts Institute of Technology as a special lecturer. Five years earlier (Sept. 30, 1920) *ENR* had first drawn the attention of the engineering world to the pioneering work then being done by Dr. Terzaghi in his laboratory at Robert College in Constantinople through the publication of an article by him entitled "Old Earth-Pressure Theories and New Test Results."

Since 1925 the Boston Society of Civil Engineers has been active in obtaining papers on soil mechanics, and in 1940 it published these papers in book form, including, in addition to papers by Karl Terzaghi, papers by Arthur Casagrande, Glennon Gilboy, Leo Jurgenson, Philip C. Rutledge, Donald W. Taylor, H. M. Westergaard and A. E. Cummings. As the initial printing of that book soon was exhausted, the society has brought out this new printing. All the papers but one were published originally in the society's *Journal*.

Mr. Blandings' Misadventures

MR. BLANDINGS BUILDS HIS DREAM HOUSE—By Eric Hodgins. 237 pp. Simon & Schuster, New York 20, N. Y. $2.75.

Engineers, contractors, well-diggers—in fact, everyone associated with the building business—will be sympathetic to the frustrations of Mr. Blandings. His misadventures begin with an inflated payment of $11,000 for an old farmhouse, and do not terminate until he has spent a total of $56,263 to remodel this into what is euphemistically called his "dream house".

The recital of what happened to this neophyte (but otherwise highly intelligent gentleman) in the mysteries of house and related construction activity is hilariously funny. But many a reader will find more than one opportunity to reflect on the sobering reality of what might be termed as Mr. Blandings' exaggerated experiences.

You can savor the style of the story from this extract, which describes the construction engineer called upon for an opinion:

". . . he was a mine of wisdom; Mr. Blandings marveled at the terms of easy familiarity on which he lived with every sort of structure: dams, bridges, tunnels, lofts, skyscrapers; even ships' hulls were matters of simple fact to him. He worked for the Port of New York Authority and had apparently been Assistant Chief of Rivet Design during the days of the building of the Great Bridge that now flung its exquisite steel shawl across the Hudson. Mr. Blandings felt a little silly at the idea of asking this master of stress-strain analysis, yield points and rupture moduli to look at an old farmhouse of which nothing had ever been asked save that it should not blow off its hillside, but Mr. Apollonio set all at ease by a wave of his thick, stubby, competent hand. 'Glad to pick up the extra money,' he said, with simple candor."

New Engineering Books

CONTRACTS IN ENGINEERING—By James I. Tucker. 341 pp. McGraw-Hill Book Co., New York 18, and London. $5.

AMERICAN PLANNING—By Cleveland Rodgers. 290 pp. Harper & Bros., New York 16, N. Y. $3.

CONNECTICUT STATE BUILDING CODE—First Edition—196 pp. Connecticut State Housing Authority, Hartford, Conn.

THE PREFABRICATED HOUSE—R. K. Graff, R. A. Matern & H. L. Williams. 132 pp. Doubleday & Co., New York 20, N. Y. $2.75.

THE HIWASSEE PROJECT—Technical Report No. 5, Vol. 1, Tennessee Valley Authority, 367 pp. Superintendent of Documents, Washington, D. C. $1.25.

HYDRAULIC MEASUREMENTS—Second Edition.—By Herbert Addison. 327 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $5.

SPEEDING FLOODS TO THE SEA—By W. E. Elam. 173 pp. The Hobson Book Press, 52 Vanderbilt Ave., New York, N. Y. $3.50.

OIL FOR VICTORY—By The Editors of Look. 287 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, and London. $3.50.

BUILDING FOR THE ARSENAL OF DEMOCRACY—Turner Construction Co., 420 Lexington Ave., New York 17, N. Y. 93 pp. Limited Edition.

Reports and Pamphlets

JOURNAL OF THE INDIAN ROADS CONGRESS—No. 1—Eleventh Session. Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi, India. Price 5s.

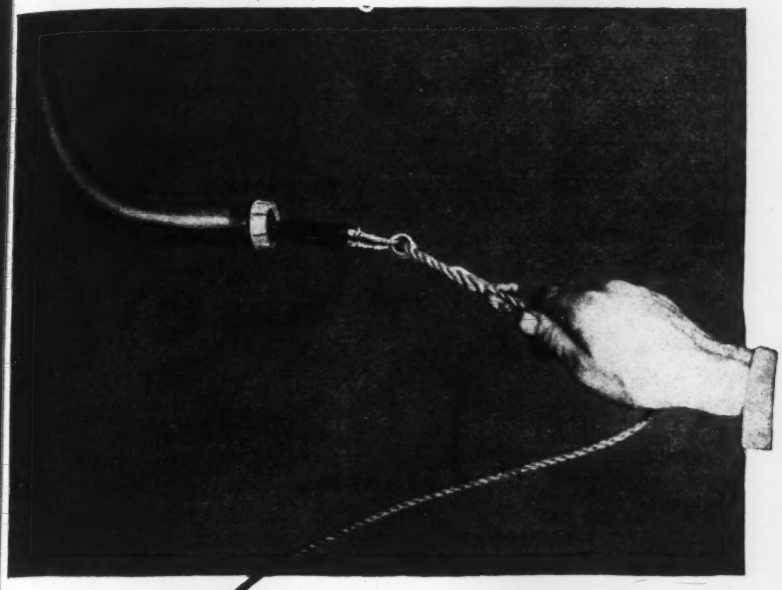
THE ORGANIZATION OF OFFICIAL TRAFFIC AGENCIES IN CITIES AND STATES—The Eno Foundation for Highway Traffic Control, Inc., Saugatuck, Conn.

70 YEARS OF GENERAL CONTRACTING—Booth & Flinn Co., Pittsburgh, Pa.

ACCREDITED UNDERGRADUATE ENGINEERING CURRICULA—Engineers' Council for Professional Development, 33 West 39 St., New York 18, N. Y. 10c.

(*Continued on page* 130)

less pull MORE SPEED



● The smooth, waxed, low-friction surface of General Electric's thermoplastic building wires shows up in *time saved* when pulling wires through conduit. Compared to other types of wire of equal capacity, it takes less "pull," makes fishing easier when joints and angle bends are encountered. And the tough, abrasion-resistant finish protects the insulation from possible damage.

No wonder General Electric thermoplastic has moved up so fast as a favorite among contractors and their customers alike. For, in addition to its smooth surface, it has cost-saving advantages *all the way through.* It strips easily. It is practically nonaging. It is virtually unaffected by oil or water. It has made possible building wires of small diameter, without lowering insulation standards.

Don't risk buying, or specifying, building wire by type alone. First, get all the facts about General Electric's thermoplastic building wire by writing to Section W58-432, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

Thermoplastic
First . . . and foremost
Type T Building Wire

GENERAL ELECTRIC

AROUND THE CIRCUIT with your G-E Merchandise Distributor

G. E. OFFERS A COMPLETE LINE OF BUILDING WIRES

Besides G-E thermoplastic, Types T and TW, for dry and wet locations, there's standard code grade building wires, Types R and RH, (Type RH in sizes 6 Awg and larger can often be used more rating). In addition, G. E. offers Types RW (moisture resistant), RD (flat twin-braided building wire), and RL and RHL (leaded cable economically than Type R, because of its higher current construction).

THERMOPLASTIC INSULATION PLAYS AN IMPORTANT ROLE in cable insulation today, too. Take PVX, for instance. This nonmetallic sheathed cable is lighter, has smaller diameter, and is more flexible than ordinary cables. These features are the result of skilled engineering in cable construction. They are built into PVX to give you easy handling, to speed installation, and to *keep PVX on the job* after it has been installed. Let us give you more information on this outstanding cable. You'll find many uses for it.

A DOZEN BATHS A DAY may sound like overdoing things, but not when you are talking about General Electric's testing laboratories. Here, samples of wire, or cable, are immersed in oil or water and tested for dielectric strength and insulation resistance. Many thousand tests for these and other properties have been made for your protection. These careful checks on quality mean that when you order any General Electric wire or cable, you can always be sure that it will perform long and well when put in service.

BX* GOLDEN ANNIVERSARY — Fifty years ago General Electric introduced BX armored cable. Today, the improved BX cable is manufactured with a bonding strip to assure low value of armor resistance. Let us show you a sample.

*Trade-mark Reg. U. S. Pat. off.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS billet *be*	RIVETS ½-in. structural	WIRE NAILS Based	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.50	$2.45	$5.25	3.75/4.50	....	$50.00	$57.00	Not	$3.00	$3.65/4.50	$2.80	$6.50
Chicago	2.50	2.45	5.25	3.75/4.50	$3.00	50.00	57.00	avail-	3.00	3.65/4.50	2.80	6.50
Pittsburgh	2.50	2.45	5.25	3.75/4.50	3.00	50.00	57.00	able	3.00	3.65/4.50	2.80	6.50
Buffalo	2.50	2.45	....	....	3.00	.....	.....	.....	....	....	2.80	....
Cleveland	....	2.45	5.25	3.85	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.45	....	....	....	.....	.....	.....	....	3.65/4.50	....	....
Detroit	....	2.60‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.735*a*	2.835*a*	....	....	....	.....	.....	.....	....	....	....	....
Geneva	2.65	.....	.....	....	....	.....	.....	.....	....	....	....	....
Los Angeles	3.37/3.41‡	3.025‡	....	....	....	.....	.....	.....	....	....	....	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl. *e* Mill lengths. Add $ .50 for cut lengths.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb base price	REINFORCING BARS*g* Per 100 lb., base price*u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.05‡	$4.12‡	$4.12‡	$.025	$.10	$23.16	$25.30	$2.00	$1.50	$2.12	$3.35
Baltimore	4.25	3.635	....	....	.10	29.00	31.00	1.88	1.42	2.00	3.25
Birmingham	2.50*a*	2.45*a*	2.45*a*	.05	.10	37.50*p*	40.50*p*	1.98	1.49	2.10	....
Boston	4.162‡	4.194‡	2.97*c*	$20 C.L.	.10	18.50	20.50	1.94	1.46	2.05	3.02
Chicago	4.05	3.80	2.60/2.95*a*	.05	.05	24.00‡	26.00	1.85	1.40	1.96	3.00
Cincinnati	....	....	....	....	....	.....	.....	1.87	1.41	1.96	....
Cleveland	4.311	3.40*e*	....	.025	.10	26.00	28.00	1.84	1.40	1.95	....
Dallas	6.00	5.00	5.00	....	....	31.00	35.00	2.11	1.57	2.22	....
Denver	5.50	4.97*c*	....	....	....	38.50	41.00*q*	2.15	1.60	2.28	....
Detroit	4.42‡	3.591‡	3.591‡	....	.10	38.00‡	42.00‡	1.86	1.41	1.97	3.31
Kansas City	4.85	2.95*cd*	2.80*cd*	.0	.05	30.00	32.00	1.96	1.48	2.08	3.0826
Los Angeles	5.20*f*	3.025	2.875	.03	.05	23.00	27.50	2.11	1.57	2.24	5.20
Minneapolis	4.43¾‡	3.69	3.69	.0	.10	26.50	28.50	1.98	1.49	2.10	3.47*d*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*hi*	38.70*hi*	2.87	3.54*i*	2.96*im*	73.00*j*
New Orleans	4.408‡	4.18*o*	....	.05	.10	27.50	29.50	2.00	1.50	2.12	3.125
New York	4.17*r*	3.85	....	....	.10/.15	30.50*st*	32.505*st*	1.97	1.44	2.19	2.74
Philadelphia	3.97	4.24	....	....	....	22.50‡	24.75‡	1.89	1.43	2.00	3.41
Pittsburgh	3.80	3.20	3.20	.05	.10	23.00	26.80	1.77	1.35	1.88	3.00
St Louis	3.93	3.49	3.49	.0	.05	34.00	36.00	1.87	1.42	1.97	....
San Francisco	4.90	3.83	2.875	.025	.10	28.00	31.50	2.11	1.57	2.24	4.50
Seattle	3.368*e*	3.368*e*	....	....	....	43.50	44.00	2.11	1.57	2.24	4.37*e*

‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. customer's spur. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* Price per ton. *m* Per sq. yd. *n* Practically no carloads are available. Retail price delivered is $27.00 for std. diamond mesh and $29.00 for std. ribbed. *o* 5 to 15 tons Base. *p* Deliveries of 5000 sq. yd. or less. *q* ⅜ in. standard ribbed. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extras—¾ in. and over $.15, ⅝ in. $.20, ½ in. $.30, ⅜ in. $.50, ¼ in. $1.20. *v* $2.99 for 25 tons and over.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered std. 8 in. s.s.	std. 12 in s.s.	24 in.	36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in	8 in.	CONCRETE SEWER PIPE Per ft., delivered: ASTM 12 in.	C 14–41 24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	Galv %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$70.28	$0.43	$0.67	$3.39	....	$114.00	$140.00	$0.45	$2.00	53.2	40.2	50*f*7	37.2
Baltimore	74.60	.35	.60	2.70	$7.25	160.00	200.00	.85	2.25	56.9	43.9	54.4	40.9
Birmingham	65.00	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	53.2	40.2	50.7	37.2
Boston	77.20	.392*m*	.756*m*	3.15*m*	7.995*m*	170.00‡*m*	265.00‡*m*	.53*h*	2.04*h*	55.2	42.2	52.7	39.2
Chicago	75.56	.49	.95	3.60	....	200.00‡	270.00‡	.65	2.25	59.0*t*	46.0*t*	55.5*t*	42.0*t*
Cincinnati	74.36	....	....	...	....	.....	.....	.54	2.00	57.4	44.4	54.9	41.4
Cleveland	76.04	.308*q*	.594*q*	2.655*q*	7.0725*q*	112.00*p*	176.00*p*	.58	2.25	59.65	46.65	57.15	43.65
Dallas	77.78	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	51.3	38.3	48.8	35.3
Denver	82.62	.38	.68	2.84	....	154.00	295.00	.64	2.25	49.4	36.4	46.7	33.2
Detroit	76.04	.455	.8775	3.69	8.50*l*	170.00‡*m*	263.00‡	.50	1.90	57.9	44.9	55.4	41.9
Kansas City	77.12	.345	.625	2.48	7.00	175.00	312.00*m*	.50	1.70	54.7	41.7	51.8	38.3
Los Angeles	89.00	.414†	.745†	2.988	7.47	157.00	260.00	1.25	2.50	....	....	....	....
Minneapolis	79.10	.51†*o*	.98†*o*	3.95†*o*	....	.....	.....	1.04*h*	2.67*h*	54.8	41.8	51.9	38.4
Montreal	78.20	.68	1.20	3.94	6.38*e*	.48*p*	.68*p*	72.00*jk*	218.00*jk*	....	....	....	....
New Orleans	72.68	.40	.72	3.06*r*	....	.....	.....	.55	1.95	52.8	39.8	50.3	36.8
New York	73.80	.52	1.01	4.00	9.43	.....	.....	.75*h*	1.85	56.2	43.2	53.7	40.2
Philadelphia	72.20	.50	.95	3.95	9.75	220.00	275.00	.90*h*	2.75*h*	56.7	43.7	54.2	40.7
Pittsburgh	76.52	.322†*m*	.631†*m*	2.70†*m*	6.625*m*	124.20	193.90	1.05*h*	2.50*gh*	60.0*t*	47.0*t*	57.5*t*	44.0*t*
St Louis	73.88	.351*n*	.632*n*	2.527*n*	5.60*n*	105.80	212.00	1.20*h*	2.55*h*	56.6	43.6	53.2	39.7
San Francisco	89.00	.4375*d*	.7875*d*	3.15	7.875	159.00	265.00	.65	2.70	....	....	....	....
Seattle	90.80	.45*b*	.81*b*	....	....	.....	.....	.595*f*	1.98*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S class B and heavier, C/L lots, Burlington, N. J. (base) $70.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Double strength. *d* List. *e* 30 in. *f* Less 2% for cash. *g* Culvert pipe. *h* Reinforced. *j* Centri-spun. *k* Per 100 feet. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per foot. 5% discount 10th of month following. *q* March prices were F.o.b. cars. *r* March price for double strength. *s* Discounts from standard list consumers carload prices. Base price approx $200 per net ton. List prices per ft.: ¼ in., 8¼c.; ⅜ in., 11¼c.; 1 in., 17c.; 2 in. 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Buttweld — 1 in. and 1¼ in. black, 34, galv., 16; 1½ in. black, 38, galv., 18½; 2 in. black, 37½, galv., 18. Lapweld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR

All S. L. Y. P. is No. 2 common or better and for No. 1 N C Box. (Prices in Bold Face)
All Fir planks No. 2 common. Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)

	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh
Atlanta	**$70.00**	**$70.00**	**$65.00**	**$65.00**	**$65.00**	**$65.00**	.....	.....	.....
	90.00	*90.00*	*88.50*	*88.50*	*87.50*	*87.50*	*$81.00*	*$80.50*	*$79.50*
Baltimore	**78.00**	**80.00**	**80.00**	**78.00**	**82.00**	**86.00**	**95.00**	.....	.....
	88.00	*90.00*	*93.00*	*92.00*	*94.00*	*94.00*	*100.00*	*100.00*	*100.00*
Birmingham	**87.50**	**87.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....
	92.50	*92.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*97.00*	*98.00*
Boston	**70.00**[g]	**72.00**[g]	**66.50**[g]	**62.50**[g]	**70.50**[g]	**74.50**[g]	**70.25**[g]	.....	.....
	64.75	*64.75*	*62.75*	*63.25*	*62.75*	*62.75*	*60.50*	*59.50*	*59.50*
Chicago	‡ **100.00**	**100.00**	**95.00**	**95.00**	**95.00**	**98.00**	**98.00**	.....	.....
	‡ *100.00*	*100.00*	*96.00*	*96.00*	*96.00*	*98.00*	*96.00*	*96.00*	*96.00*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	*k* **110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**115.00**	.....	.....	.....
	k 125.00	*125.00*	*125.00*	*125.00*	*125.00*	*130.00*	*135.00*	*135.00*	*140.00*
Dallas	**59.00**	**59.00**	**56.75**	**57.75**	**59.00**	**61.50**	**61.00**	.....	.....
Denver	*93.50*	*93.50*	*97.00*	*97.00*	*95.50*	*96.50*	.....	.....	.....
Detroit	**90.00**	**90.00**	**87.00**	**87.00**	**87.00**	**93.00**	**100.00**	.....	.....
	98.00	*98.00*	*96.00*	*97.00*	*97.00*	*100.00*	*105.00*	*105.00*	*110.00*
Kansas City	*a* **86.00**	**86.00**	**84.00**	**82.75**	**83.25**	**86.00**	**105.00**	.....	.....
	88.00	*88.00*	*87.50*	*87.50*	*85.50*	*87.00*	*85.00*	*105.00*	*105.00*
Los Angeles	*a 87.00*	*87.00*	*88.00*	*89.00*	*87.00*	*87.00*	*100.00*	*100.00*	*89.00*
Minneapolis	‡*b* **99.00**[g]	**97.50**	.....	.....	.....	.....	.....	.....	.....
	‡ *100.00*	*100.00*	*94.75*	*95.00*	*93.75*	*95.25*	*118.00*	*117.00*	*116.00*
Montreal	*e*[j] **69.00**	**70.00**	**64.00**	**68.00**	**70.00**	**75.00**	.20*i*	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*
New Orleans	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.....	.....	.....	.....	.....	.....	.....	.....	.....
New York	‡ **95.00**	**97.50**	**97.50**	**97.50**	**97.50**	**97.50**	**$115.00**	.....	.....
	‡	.....	*97.50*	*97.50*	*97.50*	*97.50*	*Range from $110 to $125*		
Philadelphia	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	.....	.....
	120.00	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*
Pittsburgh	**59.40**	**61.80**	**71.35**	**63.60**	**69.45**	**73.10**	**84.85**	.....	.....
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.35*	*91.35*	*96.85*	*96.85*
St. Louis	*j* **112.00**	**112.00**	**110.00**	**108.00**	**108.00**	**115.00**	**115.00**	*115.00*	*115.00*
San Francisco	*d* **91.00**	*91.00*	*87.25*	*87.25*	*86.25*	*86.25*	*81.00*	*72.50*	*72.50*
Seattle	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*

LONG LEAF Y. P. Merchantable grade up to 20 ft.

	2x12 Rgh	12x12 Rgh
Atlanta	$86.00	$86.00
	.....	.....
Baltimore	160.00	150.00
	.....	.....
Birmingham	110.00	112.50
	.....	.....
Boston	.....	.....
	.....	.....
Chicago	125.00	125.00
	.....	.....
Cincinnati	.....	.....
Cleveland	130.00	150.00
	.....	.....
Dallas	94.75	91.00
Denver	.....	.....
Detroit	95.00	110.00
	.....	.....
Kansas City	105.00	110.00
	.....	.....
Los Angeles	.....	.....
Minneapolis	.....	.....
	.....	.....
Montreal	.20*i*	.20*i*
	.....	.....
New Orleans	.....	.....
	.....	.....
New York	.....	.....
	.....	.....
Philadelphia	150.00	150.00
	.....	.....
Pittsburgh	130.60	141.00
	.....	.....
St. Louis	115.00	115.00
San Francisco	.....	.....
Seattle	.....	.....

PLYWOOD Rail freight increment (See note for base price)

	⅜"	¾"
Atlanta	$17.72	$21.57
	.....	.....
Baltimore	18.45	21.995
	.....	.....
Birmingham	17.245	20.795
	.....	.....
Boston	18.195	21.995
	.....	.....
Chicago	14.555	17.555
	.....	.....
Cincinnati	17.245	20.795
Cleveland	17.615	21.265
	.....	.....
Dallas	14.555	17.555
Denver	10.285	12.435
Detroit	17.245	20.795
	.....	.....
Kansas City	12.605	15.205
	.....	.....
Los Angeles	9.81*gh*	11.86*gh*
Minneapolis	13.765	16.615
	.....	.....
Montreal	.....	.....
	.....	.....
New Orleans	14.555	17.555
	.....	.....
New York	18.195	21.995
	.....	.....
Philadelphia	18.195	21.995
	.....	.....
Pittsburgh	17.88	21.63
	.....	.....
St. Louis	14.555	17.555
San Francisco	7.33*g*	8.83*g*
Seattle	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *c* 5M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier. San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* FBM, scarce, no stable quotation, no ceiling. *j* Delivered in 500 ft. lots. *k* These are retail yard prices. Lumber is no longer available on the base previously quoted. Less 2% for cash.

Note: Special concrete form grade Fir Plywood 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¾", $95.15; on ½", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS: Discounts from jobbers list, Jan. 16, 1946, Single or Double Thickness, A quality	WINDOW GLASS: B quality	EXPLOSIVES: Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.195
Baltimore	78%	79%	.195
Birmingham	76%	76%	.15
Boston	77%	78%	.195
Chicago	68%	68%	.195
Cincinnati	77–10%	77–10%	.195
Cleveland	67–10–10%	67–10–10%	.195
Dallas	76%	76%	.2075
Denver	68%	68%	.20
Detroit	77%	77%	.195
Kansas City	70.10%	70.10%	.195
Los Angeles	86%*d*	88%*d*	.2025
Minneapolis	68%	68%	.19
Montreal	40–5%*ab*	47%*ac*	.2125
New Orleans	....	....	.205
New York	73%	74%	.265*f*
Philadelphia	74%	75%	.195
Pittsburgh	77%	77%	.1675
St. Louis	77–10%	77–10%	.20
San Francisco	66%	73%	.20
Seattle	75%	75%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.2075

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail: Pine *	By Rail: Fir
12 in. at butt	6 in.	30 to 50 ft.	$0.34	....
12-in.—2 ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.—2 ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.—2 ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.59
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	.66
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.43	.60
14-in.—2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.65

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	.....	2.25*a*
Chicago	Red Oak	.....	2.65/2.75*a*	.....	3.55/3.70
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	.....	2.10*ag*	.....	3.25*ag*
St. Louis	White Oak	1.80	.....	2.50	.....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	.....	.....	.....
San Francisco	Douglas Fir	1.25*bef*	.....	.....	3.00*caf*
Montreal	Birch or Maple	.....	1.65	1.04	.....

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

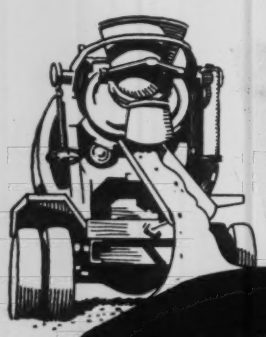
CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$2.50– 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd ton	21.50–38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.28
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.20
Sulphate of copper, in bbl., per 100-lb.	7.10

22 YEARS AGO

SEARS ROEBUCK & COMPANY WAREHOUSE
Philadelphia, Pa.
George C. Nimmons & Company—Architects
Irwin Lighton, Philadelphia—General Contractor



Many Transit-Mix Operators Say They'd Use

TRUSCON Zilicon WATERPROOFING PASTE...

if it did nothing more than lubricate the mix!

FASTER ON THE JOB
EASIER ON EQUIPMENT
SAVES TIME & LABOR
GIVES SATISFACTION

- ★ **Portland cement REQUIRES WATER for chemical reaction in the normal hardening and setting of concrete.**
- ★ **MORE WATER is needed for the practical mixing, placing and densifying of concrete than complete chemical reaction requires.**
- ★ **Water is INCOMPRESSIBLE and occupies a substantial space in the total volume of the mixed concrete.**
- ★ **Water is VOLATILE—will evaporate—and that is what all the water does that is not needed for chemical reaction.**
- ★ **This excess water is evenly distributed throughout the concrete and as it evaporates it leaves FINE CAPILLARY PORES.**
- ★ **Through the natural law of positive capillarity WATER WILL BE ABSORBED into the concrete by these fine capillary pores.**
- ★ **The simple way to make concrete non-absorptive is to change positive capillarity to negative so water will be repelled.**
- ★ **Zilicon, uniformly distributed by mixing water, coats pore walls with repellent as the water evaporates.**
- ★ **Thus concrete mixed with Truscon Zilicon Waterproofing Paste, after its initial drying, repels water and remains dry.**

Whenever concrete is handled in volume the operators have learned that the extra "workability" and easier chuting gained where Truscon Zilicon is used save both men and machines. That's important because time and manpower run into money fast these days. Truscon personnel pioneered the waterproofing of concrete and have behind them 35 years of success in licking concrete's worst enemy—water. When you use Truscon Zilicon Waterproofing Paste you get the best there is—the *proved* product—the waterproofing that cuts labor costs, saves time, lasts as long as the structure. Write for complete descriptive Zilicon folder. Dept. Z-8, *Truscon Laboratories, Division of Devoe & Raynolds Co., Inc., Detroit 11, Michigan.*

TRUSCON *Laboratories*

Reg. U.S. Pat. Off.

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$112.50	$132.60	$234.60	$244.80	$273.40	$306.00	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	23.75*k*	29.75*k*	20.00	15.00	2.50*m*
Birmingham	97.50	104.00	195.00*e*	231.00	.....	.....	19.00	21.50	20.11	17.50	.....
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	92.10	98.40	185.20	.....*x*	.....*x*	.....*x*	18.50	19.50	24.00	18.00	.....
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	99.50	106.00	195.50	.....*x*	. ....*x*	. ....*x*	24.00	24.00	19.65	17.15	22.15
Dallas	.....	83.00	.....	.....	.....	.....	18.00*dd*	20.00*dd*	28.00	22.00	15.00
Denver	105.25	119.00	198.25	230.00	263.50	315.35	26.50	.....	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	106.80	125.10	219.30	252.90	320.20	366.30	24.00*f*	26.00*f*	24.00	22.00	22.00
Kansas City	.....	.....	.....	.....	.....	.....	17.50	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	18.00	20.50	21.80	18.80	22.80
Minneapolis	136.50*cc*	151.50*cc*	270.40*cc*	151.50*vcc*	.....	.....	21.00*v*	.....*g*	30.00*bb*	23.00*bb*	30.00*bb*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*a*	.....	294.40*a*	22.10	31.80	12.50*u*	14.00*u*	8.00*u*
New Orleans	.....	.....	.....	.....	.....	.....	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*c*	166.70*hn*	.....*x*	.....*x*	25.50	.....	28.60	24.40	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	23.10	19.10	18.10
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	24.00	26.00*y*	19.40*cc*	16.90*cc*	2.85*m*
St. Louis	.....	.....	.....	.....	.....	.....	26.00*s*	25.00*s*	.65*aa*	.50*aa*	.75*s*
San Francisco	116.00	130.50	174.00	130.50*t*	.....	.....	25.00	.....	22.10	22.10	2.21*m*
Seattle	137.00	147.00	.....*x*	147.00*cew*	.....	.....	28.50*k*	33.50*k*	27.95*s*	27.95*s*	3.28*m*

* F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6 x 12 x 12 in.-3 cell *f* Includes $3.50 per M. for delivery. *g* No quotation. *h* F.o.b Perth Amboy, N. J. *i* F.o.b. Warehouse only. *k* $1.00 discount. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed tile. *o* Per bbl., 200 lb. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* 8% sales tax included *v* sand lime. *w* 5 x 8 x 12. *x* Not available. *y* Stacked *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime recently not sold per ton *dd* Price previously quoted was incorrect. This was prevailing price in Dec. Jan. and Feb. *bb* LCL, delivered. *cc* Truck delivery.

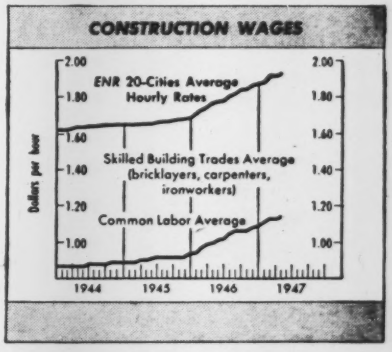
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Graphite *b*	Per gal., drums Aluminum *e*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.75	$27.375	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	18.50	27.00	2.00	3.00	2.50	2.35	2.90	2.90	.40	29.00
Birmingham	18.75	27.375	3.36	4.70	....	2.50	2.50	2.50	.33	30.50
Boston	18.50	27.00	1.75	2.50	2.31	2.00‡*h*	3.30‡*u*	3.30‡*u*	.25‡	21.00‡
Chicago	18.50	27.00	....	....	....	1.75*h*‡	2.55*h*‡	2.55*h*‡	...	29.00‡
Cincinnati	18.50	27.00	....	....	....	....	....	....	...	.....
Cleveland	18.50	27.00	3.00	3.00	3.00	2.21	2.26*o*	2.26*o*	.30*y*	33.00
Dallas	18.50	27.00	....	4.05	....	2.75*h*	2.90*h*	3.15*h*	.80	49.00
Denver	18.50	27.50	2.75	4.35	2.50	2.625	2.625*h*	2.625*h*	.365	32.40
Detroit	18.50	27.00	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	18.50	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.25	.67	.....
Los Angeles	18.75	27.50	2.80	4.00	3.50	2.60	1.90	....	.60	.....
Minneapolis	18.50	23.88	....	....	....	2.10*i*	2.15*h**i*	2.15*h**i*	.37	26.00
Montreal	.....	.....	2.90*p*	4.20*p*	3.62*p*	2.85	2.58*t*	2.07*t*	.68	1.85*k*
New York	18.50	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30	26.00
Philadelphia	18.50	27.00	1.75/2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.50	27.00	1.98	2.40	1.75	2.32	2.37*h*	2.37*h*	.37	28.00
St. Louis	18.50	27.00	2.28*s*	2.89*s*	1.96*s*	....	....	....	....	.....
San Francisco	18.75	27.25	1.80	2.75*n*	1.35	1.96*x*	....	....	.52	21.115
Seattle	18.75	27.50	1.95	3.15	....	2.75	2.80*h*	....	.41	35.00*j*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *f* Distributors' price to contractors. *g* 55 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* per cwt *n* May, 1941 price. *o* 60-lb. roll. *p* Plus 8% sales tax. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll. *v* Truck delivery. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.50	$1.75	$1.75	$2.00	$0.75	$0.85
Baltimore	2.25*b*	1.775	2.00	1.625/2.00	1.725	.95	.95
Birmingham	1.9375	1.50	1.75	1.50/1.75	1.875	.75	.85
Boston	1.995	1.75	1.85	1.80	2.00	1.25	1.25
Chicago	2.00	1.95	2.00	1.95	2.00	1.30	1.30
Cincinnati	.....	....	....	.....	.....	.....	.....
Cleveland	2.125	2.00	2.125	1.55/2.125	2.125	1.275	1.375
Dallas	2.00	1.625	1.75	1.75	1.875	.90	.90/1.25
Denver	1.98*b*	1.70	1.70*b*	1.70*b*	1.90	1.10	1.35
Detroit	2.00	1.825	2.00	1.85/2.00	2.00	1.275	1.275
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	2.00	1.75	2.00	1.75	2.05	1.25	1.25
Minneapolis	1.825	1.65	1.75	1.70	1.90	1.15	1.15
New Orleans	1.9375	1.50	1.875	1.75	1.875	.80	.80
New York	2.50*b*	2.50*b*	2.50	2.50*b*	2.50*b*	1.50	1.50
Philadelphia	2.00/2.25	1.775	1.90/2.00	2.25	2.00/2.25	1.025	1.025
Pittsburgh	2.15	2.00	2.00	2.05	2.00	1.15	1.15
St. Louis	2.25	1.95	2.00	2.20	2.25	1.20	1.20
San Francisco	2.25	1.75	2.00	1.85	2.25	1.25	.125
Seattle	2.105	1.805	1.93	1.95	2.105	1.405	1.30
Montreal*	1.17	1.06	1.11	1.00	1.17	.73	.73



b 7 hr. day. * Cost of living bonus now included in basic wage.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.935

ENR Common Average: $1.138

YOU NAME IT...

we'll build it

Maybe you're planning a large structure—for instance, one destined for a place among the country's leading skyscrapers. Or something smaller—perhaps an apartment building, or a short highway bridge.

But whatever it is, large or small, if it's worth building at all, it's worth building well. And that's reason enough, we suggest, to entrust the construction job to Bethlehem.

With an able engineering staff and long and varied experience in dealing with all phases of steel construction, Bethlehem is well qualified to handle any problem involving the fabrication and erection of steel.

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FABRICATED STEEL CONSTRUCTION

BETHLEHEM STEEL

New Aids to the Constructor

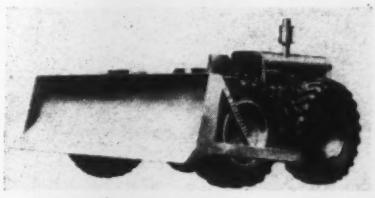
MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

PLASTIC COMPOSITION FLOORING—Plastic composition flooring for use in residential construction, "Oaktred," has ingredients including sawdust, asbestos, binding chemicals which result in high strength and resilience. The material is to be mixed with water on the site and then troweled on like cement to a minimum thickness of 5/8 in. The result is a monolithic flooring which can be sanded to a smooth finish and then varnished or shellacked.

The flooring can be applied on subflooring, concrete, or over old flooring. It can be scored to resemble tile or random-width oak flooring. The finished flooring has a color similar to that of medium oak flooring.—*Kompolite Co., Brooklyn, N. Y.*

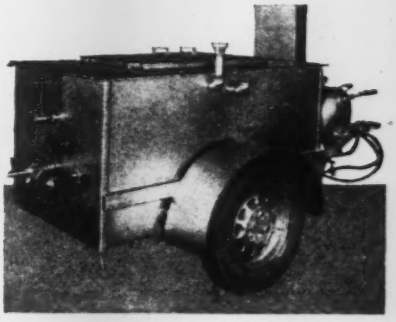
HARD METAL PERCUSSION BITS—A development in rock drilling bits which promises economical mine operation consists of a technique of permanently mounting ultra-hard Carboloy cemented carbide inserts in 4-point jackbits. To go along with this is a new, special, harder and longer wearing alloy steel drill rod with a special high-toughness stud connector to mount the bits on the drill rod, developed by Ingersoll-Rand. In granite, in which steel bits will drill 2 to 3 ft. before requiring sharpening, the Ingersoll-Rand Carboloy-set jackbits will drill up to 250 ft. before dulling.

In general, the new bits will produce between 50 and 200 times (depending on type of formation being drilled) the depth of hole obtainable with steel bits without reconditioning.—*Carboloy Co., Inc. Detroit, Mich.*

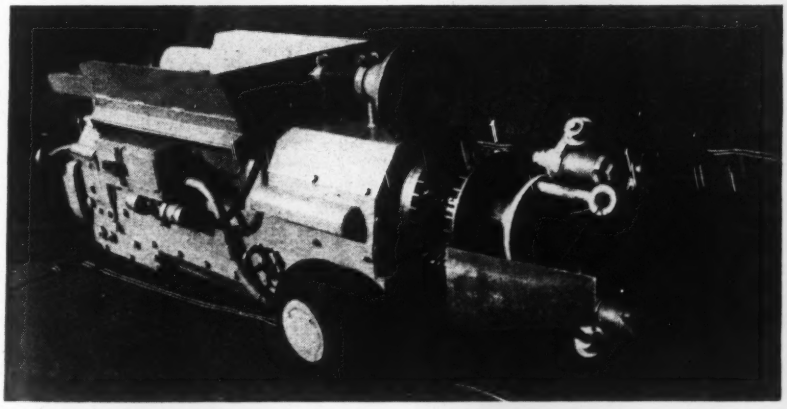


RUBBER-TIRED TOURNADOZER—A high-speed rubber-tired Model C Tournadozer is powered by a 160-hp. diesel engine. It has four forward speeds ranging up to 12 mph., and the same four speeds are available in reverse, and a Tournamatic constant-mesh transmission, with which the operator can select any gear ratio or change from forward into reverse with no shifting of gears and no loss of momentum.

The Tournadozer is at its greatest advantage on work requiring much backing and maneuvering. Ability to operate over paved areas without damage further broadens job mobility and usefulness. Based on common earth excavation and 60-minute operating efficiency, it can move 184 cu. yd. an hour on a 50 ft. haul; 118 yd. on a 100 ft. haul; 66 on a 200 ft. haul; 46 on a 300 ft. haul; and 35 yd. on a 400 ft. haul.—*R. G. LeTourneau, Inc., Peoria, Ill.*



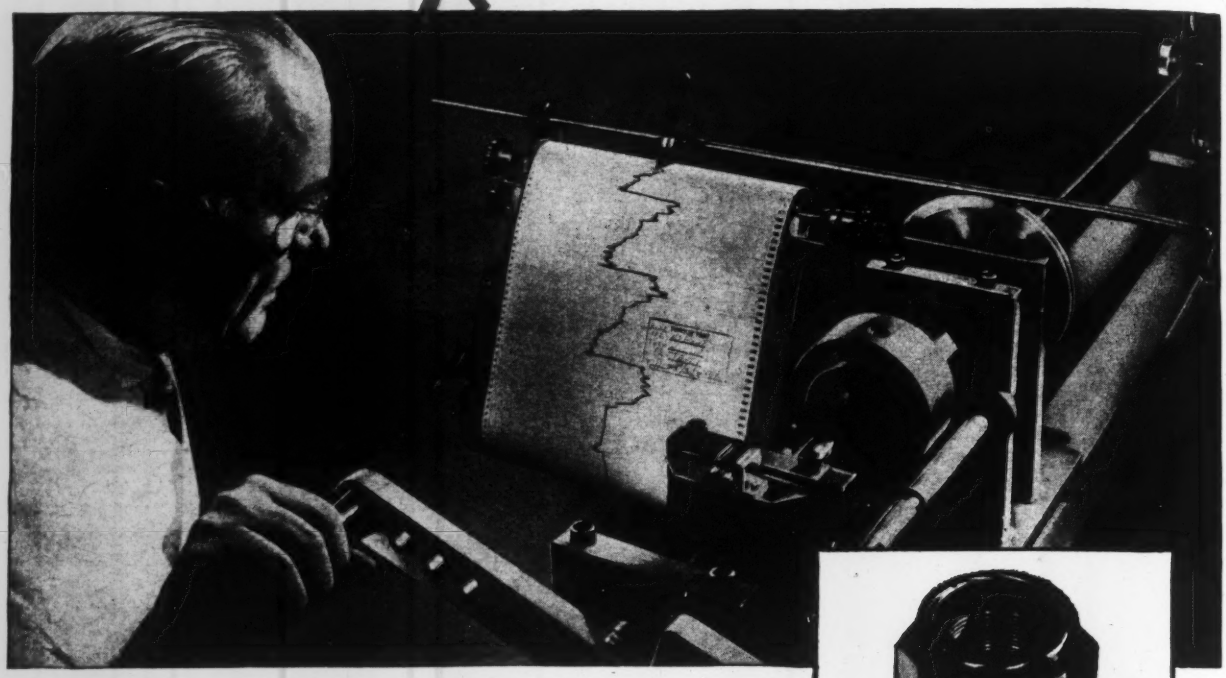
DOUBLE-BOILER ROAD KETTLE—Model F-10 has inner kettle to contain filler compound. It is surrounded by outer kettle containing heat transferring agent, such as special oil. Two kettles are mounted in regular kettle housing, completely insulated by asbestos. Two kerosene burners are furnished for rapid starting. Oil is raised to 500 deg. in from 30 to 45 min. and that heat maintained with one burner. Oil can be heated to any temperature up to its flash point of 750 deg. Compound in inner kettle gradually raises to proper temperature without any hazard of coking or over-heating. Inner kettle is divided by screen into two sections, so that, during operations, compound can be added to front section to melt and flow through to rear section. Screen prevents passage of semi-molten material to obstruct kettle outlet. In rear compartment of compound kettle is a hand operated paddle-type agitator for stirring compound, which moves through 160 deg.—*White Manufacturing Co., Elkhart, Ind.*



LINING 24-IN. PIPE—Pipe as small as 24-in. dia. can now be concrete lined in place for any length. Concrete is applied centrifugally through a dispensing head that throws a measured amount of material per foot as the machine advances. Revolving trowels smooth the concrete to give a hard finished surface resistant to tuberculation and electrolysis. A man rides a trailer with the machine, inspects and controls its operation. This machine is a compact counterpart of units used for pipes 84 to 30 in. dia. for the past few years.—*Centriline Corp., 140 Cedar St., New York 6, N. Y.*

STEEL MAT FLOORING—Heavy-duty Hexteel floor armor is hexagonal-shaped steel grid which is easily embedded in concrete or mastic, over old or new

A-N TORQUE TESTS *Prove Reusability* OF ELASTIC STOP NUTS



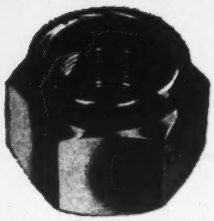
—the Red Elastic Collar provides dependable locking torque for RE-USE!

Army and Navy specifications for aircraft lock nuts include a specific torque test to prove locking effectiveness. Lock nuts have to maintain adequate locking torque through 15 on-and-off cycles.

ESNA Elastic Stop Nuts—with the Red Elastic Collar that has become a symbol of security to all aviation engineers—remain self-locking against Vibration, Impact and Stress Reversal in both pre-stressed and positioned settings.

In addition, the self-locking, self-sealing and reusable Red Elastic Collar protects the bolt. It does not deform the bolt, damage the threads or gall the finish.

Reusable ESNA Elastic Stop Nuts provide dependable protection against Vibration, Thread Corrosion, Thread Failure, and Liquid Seepage. This multiple protection—which has made Elastic Stop Nuts the standard fastener on many products—also achieves the double economy of inventory simplification and reduced procurement costs. ESNA engineers are now ready to study your fastener problems. Address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are conveniently located in many principal cities.



The RED ELASTIC COLLAR

— denoting an ESNA product —

. . . is threadless and dependably elastic. Every bolt—*regardless of commercial tolerances*—impresses (does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates all axial play between bolt and nut threads.

Torque tests—for Elastic Stop Nuts—are based on a steel-to-steel frictional coefficient of .18. Bolt loadings are figured at 40,000 psi for commercial bolts; 90,000 psi for aircraft bolts.

ESNA

ELASTIC STOP NUTS

INTERNAL WRENCHING

ANCHOR

WING

SPLINE

CLINCH

GANG CHANNEL

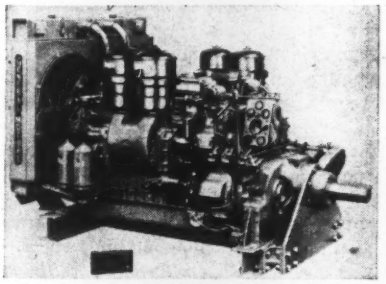
CAP

PRODUCTS OF: **ELASTIC STOP NUT CORPORATION OF AMERICA**

floors, to make solid, level floor. Exposed steel top of mesh, flush with surface, takes shocks and carries brunt of loads. Floorsteel is flexible floor armor of high quality cold-rolled strip steel which comes in standard rolls 47½ in. or 60 in. wide and 25 ft. long. It rolls out like a rug over new or old floor to be resurfaced. In appearance it is similar to the mesh used during the war by the Navy, but is much heavier.—*Klemp Co., 6601 S. Melvina Ave., Chicago 38, Ill.*

SNOW REMOVER—There's no snow too deep for a Tucker Sno-Cat, it is claimed. Broad, rugged ski-runners and "floating drive" link tracks enable it to operate with equal ease over ice or free, heavy snow; with the wheels lowered, it can travel over bare ground. Special attention has been given to the problem of side-hill slippage, and the machine will navigate cross-hill on slopes up to 35 percent.

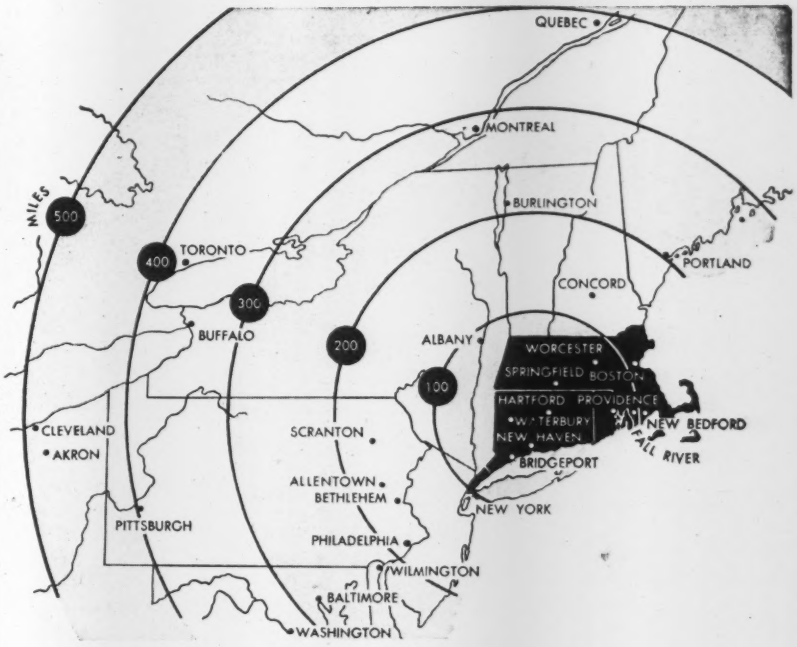
Speeds range from 3 to 10 mph. in deep heavy snow, up to 10 and 15 mph. on roads and broken trails. A Dodge 115 hp. motor, with four-speed transmission, low-ratio rear end drive, radiator and drive shaft brakes powers it.—*Tucker Sno-Cat Co., Grass Valley, Calif.*



DIESEL ENGINES—General Motors Series 71 "Twin 6" diesel engine models incorporate engineering improvements. Each Twin unit is made up of two basic GM 6-cylinder 2-cycle engines mounted side by side and geared to a single shaft. Units are offered with either right or left-hand rotation. Continuous BHP at 1800 rpm. is 276 with maximum intermittent ating of 400 at 2.000 rpm.

An outstanding feature is the variety of power take-off arrangements. Any

Aiming for More Customers?



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Being close to this tremendous purchasing power is just one of many advantages enjoyed by industry in Southern New England.

For more facts to help you plan for future profits, write for a free copy of "SOUTHERN NEW ENGLAND FOR TOMORROW'S INDUSTRY." Address: P. E. Benjamin, Mgr., Industrial Development, New Haven Railroad, Room 201H, 80 Federal St., Boston 10, Mass.

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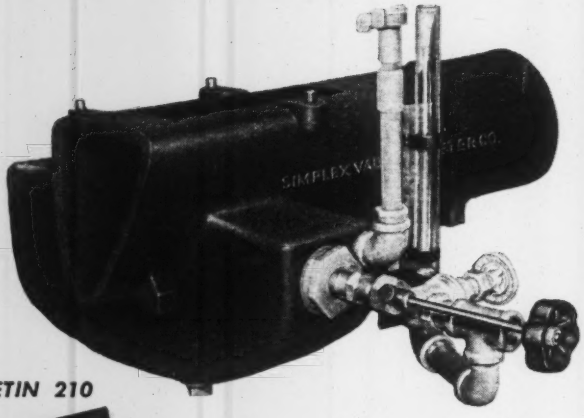

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WRITE TODAY FOR YOUR COPY OF SIMPLEX BULLETIN 210—describing the operation, installation and capacity of the new SIMPLEX Type-S Parabolic flume. Contains necessary detailed data for design and specification purposes. Address inquiries to Dept. 254.

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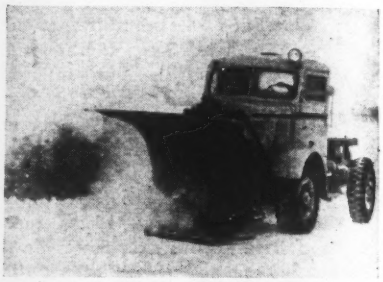
one of four different transfer gear types can be selected.—*Detroit Diesel Engine Division, General Motors Corp., Detroit 23, Mich.*

CEMENT CARRIER—A new bulk cement carrier, Model 100-B, transports a load from 100 to 110 bbl. of dry cement and is powered to discharge the full load in four minutes. The body has three manhole filler openings. Each opening has a hinged cover with manual locking device and is fitted with a tubular rubber gasket. The discharge door at the rear is circular, with rubber gasket.

The power unit is a Wisconsin air cooled gasoline engine of four cylinders, and the carrier is mounted on a trailer. —*Hercules Steel Products Corp., Galion, Ohio.*



SNOW MOVING—A hydraulic reversible plow with a moldboard shaped so that snow is picked up by the whole length of the cutting blade and moved in a helical path across it to discharge snow at an angle above the moldboard has been perfected for airport snow plowing. The high cutting angle gives more side-thrust than is found in highway plows but this is overcome by powering with a Four-Wheel Drive truck that moves the plow at high speed.—*Four Wheel Drive Auto Co., Clintonville, Wis.*

PNEUMATIC TIE TAMPER—Well-balanced design, even-hitting qualities, weight and coordinated valve timing make new tie tamper easy to handle. All parts are special analysis steel, heat treated for their particular function. Standard tamping bar has $\frac{5}{8}$x3-in. face and is 24 in. long; total weight 42 lbs.—*Schramm, Inc., West Chester, Pa.*

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IN 1846, twenty three years before the Golden Spike was driven at Ogden, Utah marking the completion of the first transcontinental railway, John August Roebling built America's first truly practical, wire rope suspension bridge. This bridge, which carried traffic across the Monongahela River for scores of years, stood as a silent testimonial to his confidence in a principle of bridge building which, in that day, was looked upon with considerable misgiving.

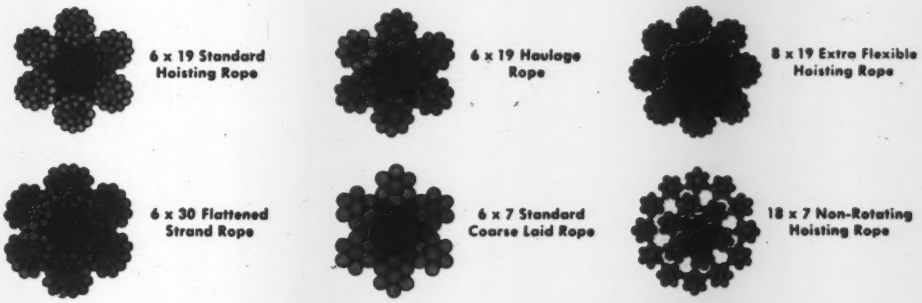
How much is this confidence worth to bridge engineers, and to humanity as a whole, today?

Had it not been for his confidence there would have been no Brooklyn, George Washington nor Golden Gate Bridges. Had it not been for your confidence in the company that bears this pioneer's name, there could have been no John A. Roebling's Sons Company.

Your confidence is valued above all of this company's assets. Every Roebling employee's job depends upon his ability to preserve that confidence by producing better products and by giving you better service than you can find elsewhere.

Any product is only as good as the organization that makes it.

FOR THE RIGHT ROPE FOR YOUR EQUIPMENT CHOOSE A "BLUE CENTER" STEEL WIRE ROPE!


6 x 19 Standard Hoisting Rope
6 x 19 Haulage Rope
8 x 19 Extra Flexible Hoisting Rope
6 x 30 Flattened Strand Rope
6 x 7 Standard Coarse Laid Rope
18 x 7 Non-Rotating Hoisting Rope

It's easy to find the right wire rope for your job when you can choose from a wide range—the one construction, size, and grade of steel that will give you most service at lowest over-all cost.

That's why, whatever you need in wire rope, you're sure of finding it in Roebling's *complete* line of "Blue Center" Steel Wire Rope, in either preformed or non-preformed types. Illustrated are just a few of the more commonly used constructions. Each is the finest we know how to make... and each of them is made of Roebling's famous "Blue Center" Steel.

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Men and Jobs

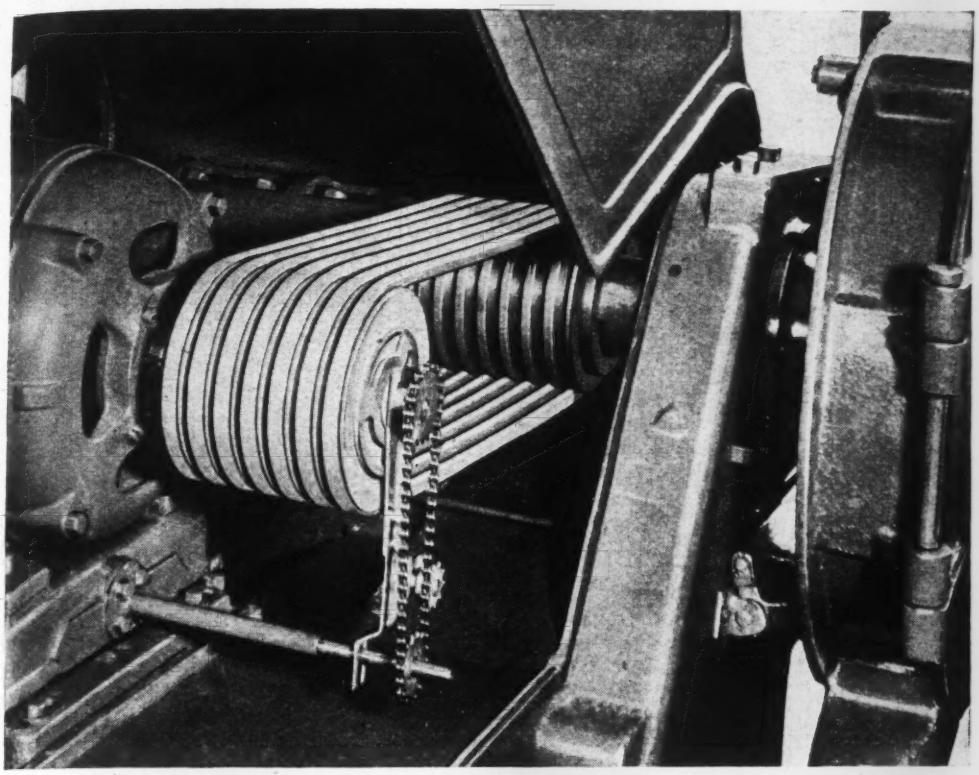
Col. Samuel N. Karrick, Corps of Engineers, has become district engineer, San Francisco district, relieving Col. George Mayo who is retiring after 31 years of continuous Army service. He recently was a member of the joint Army-Navy board for a second San Francisco Bay crossing and served on the California Debris Commission.

Colonel Karrick arrived in San Francisco after 32 months in the Southwest Pacific. During the advance from Australia to the Philippines Colonel Karrick built and commanded the large Army bases at Milne Bay, New Guinea, and Biak Island, Netherlands East Indies. After Manila's capture he commanded the Manila engineer district and engineer troops charged with Army construction in the Philippines. Previously, he was district engineer, Chicago district, from 1935 to 1940.

Carl West of St. Catherines, Ont., has been named director of canal services of the Canadian Department of Transport, succeeding E. B. Jost, retired. Mr. West was formerly superintending engineer of the Welland Canal System, Ontario.

Frederic D. Foss, Harry R. Halloran and Fred W. Narr have formed the firm of Foss-Halloran-Narr, Inc., at 29-28 Forty-first Ave., Long Island City 1, N. Y., to do general contract work, specializing in foundations and structural concrete in the New York area. Mr. Foss and Mr. Narr have been with Corbetta Construction Co. for the last few years. Foss previously was with the New York City Housing Authority and Tishman Realty and Construction Co., Narr for several years was with White Construction Co. Mr. Halloran is from the Foundation and Conduit Co., Philadelphia, Pa., with whom he will continue in addition to his interests in the New York City organization.

Martin A. Mason, engineer of the Beach Erosion Board, Office of the Chief of Engineers, has won the 1946 Washington Academy of Sciences award in engineering science, "in recognition of his distinguished service in



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- To regulate a machine tool to suit variations in job, material, or individual workman
- To control the volume of air from heating and ventilating fans
- To vary the speed of a pump, spinning frame, conveyor, rock crusher or grinding wheel
- *Wherever* the ability to change operating speeds at will can add to efficiency, output or economy —

Install Texrope Variable Speed Drives!

These flexible drives use economical constant speed motors. They provide infinite speed variations within their ranges — quickly, easily, accurately.

Vari-Pitch sheaves using A, B, C, D or E belts are available for stationary or motion control, with range up to 25% per sheave; *Vari-Pitch* sheaves using Q or R wide belts allow variations up to 100%; *Vari-Pitch* speed changers permit ranges up to 375%. There are types and sizes to suit all needs, from fractional to 300 hp!

Texrope offers the *most complete* line of variable speed drives made . . . engineered and built by Allis-Chalmers, originator of the multiple V-belt drive. See Sweet's Catalog, or call your nearby A-C office or dealer for Bulletin 20B6051G. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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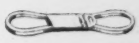

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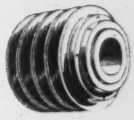

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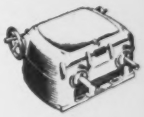
Exact variations in speed, stationery or motion control.



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erosion studies leading to successful invasions on Japanese beaches by our armed forces."

B. J. Fry, chief engineer, and **E. E. Norwood,** project engineer, have been elected vice-presidents of E. J. Albrecht Co., heavy engineering contractors of Chicago, Ill. Mr. Fry has been with the company, except for a period of Army service since 1932, and Mr. Norwood since 1934.

August J. Mueller has been appointed buildings engineer for Baltimore County, Md., succeeding Bayard Fonda, who resigned to resume the private practice of engineering. **Charles H. Doing,** recently appointed zoning commissioner, will continue in charge of zoning regulations, which are to be correlated with buildings regulations and restrictions.

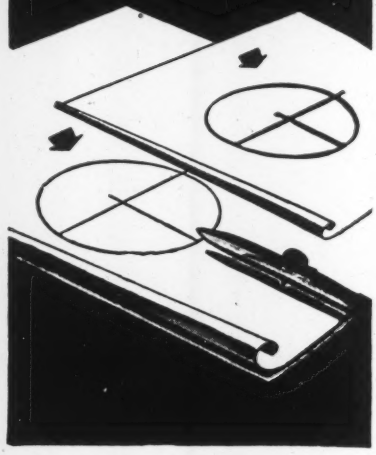
Konstantine L. Kollar recently joined the engineering staff of the Washington office of the Health & Sanitation Division of the Institute of Inter-American Affairs. Mr. Kollar went from the United States Navy, where he was sanitary engineer in the Bureau of Yards and Docks. He is a graduate of the College of the City of New York, where he took his B. S. in civil engineering in 1939. After graduation, he went with the United States Geological Survey, Department of Interior, where he was assigned to surface waters.

James M. Lackey has been appointed district engineer for southern California and Arizona of The Asphalt Institute, with headquarters in Los Angeles. A registered civil engineer, Lackey has had more than 22 years with the California division of highways. For last 13 years he has supervised all asphalt paving in Los Angeles district in his position as senior highway engineer.

Charles S. Clark of Donna, Tex., chairman of the Texas State Board of Water Engineers, has resigned to enter private business. Clark has been chairman for 12 years and has been a member of the board for 30 years.

Alfred C. Mabane, former office engineer on the TVA Watts Bar project, has been appointed chief construction engineer on the Corps of Engineers' Clark's Hill Hydro-Electric project at Augusta, Ga.

Tracing cloth that defies time



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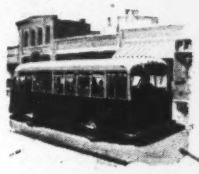

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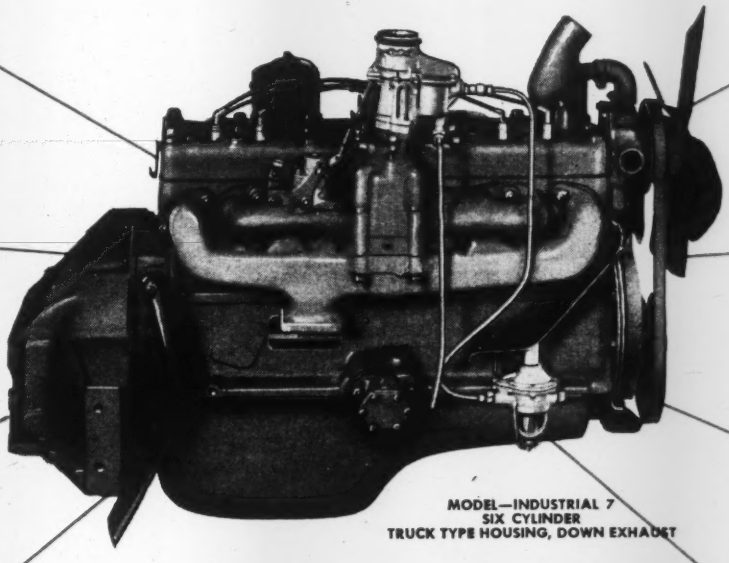

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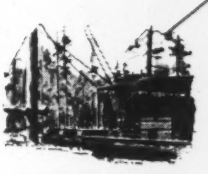

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ENGINEERING SCHOOL NEWS

After a 3-year interruption the civil engineering department of the University of Minnesota will hold its summer surveying camp this year. A new location, the former Gopher Ordnance area near Rosemont, Minn., will be used. During 1944, 1945, and 1946 some of the work normally carried on at camp was included in a course given on the campus during the summer quarter.

Anticipated registration for this summer is about 120, more than double any previous enrollment. Prof. R. C. Brinker, who was on the camp staff during the 1931-33 period, will be in general charge. Most camps have run a 6-week period, giving nine quarter credits. In order to permit students to attend the full summer quarter to be offered by the university this year, the camp session will be condensed to four weeks in September. The work will include railroad and highway surveys, topographic mapping, hydrographic surveys (both stream measurement and sounding), triangulation and base line work, astronomical observations, and the computations and drafting in connection with them.

Malcolm Pirnie, of Malcolm Pirnie Engineers, New York, has been elected to the board of trustees of Robert College, Istanbul, Turkey. He replaces the late Collins P. Bliss, dean emeritus of the New York University College of Engineering. Robert College, one of eight affiliated in the Near East College Association, introduced American engineering instruction to Turkey and the Near East when a school of engineering was opened in 1912. Last year about one-third of the 953 students studied engineering.

Two Washington civil engineers have been named to the advisory committee of the photogrammetry department at Syracuse University, reports Dean Louis Mitchell of the College of Applied Science. They are Lewis A. Dickerson, chief of the photogrammetric division of the Army Map Service, and George D. Whitmore, chief of the research and technical control division of the U. S. Geological Survey.

Dickerson has been with the U. S. Army Corps of Engineers since 1935. He returned from the European Theater in 1945 after two years as a staff officer in the aerial mapping division of the Army Engineers. He was released from active duty last June as a lieutenant-colonel. He is a graduate of the University of Cincinnati.

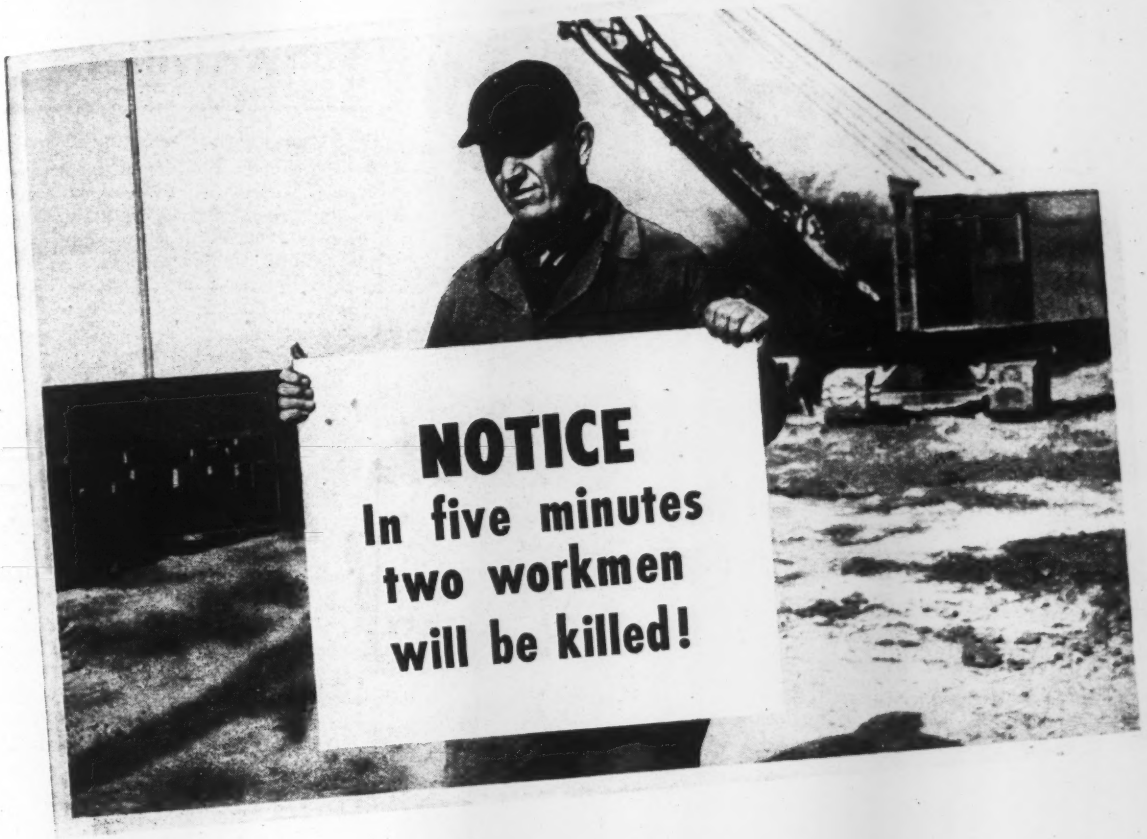
Whitmore formerly served as chief civil engineer with the maps and surveys division of the Tennessee Valley Authority and is the author of several books on geodetic surveying and photogrammetry. He has been consulting engineer to many cities in the East, South, and Midwest.

Dickerson and Whitmore will work with Carl L. Bausch, vice-president of Bausch and Lomb Optical Co., Thomas P. Pendleton, chief topographical engineer with the U. S. Geological Survey, E. R. Polley, president of Fairchild Aerial Surveys, Lima, Peru, and Lt. Comdr. Oliver S. Reading of the U. S. Coast and Geodetic Survey.

J. F. Downie Smith has resigned as head of the engineering department of the United Shoe Machinery Corp. research division, to become dean of engineering, director of the Iowa Engineering Experiment Station, and director of the engineering extension service at Iowa State College. After being graduated from The Royal Technical College, and from Glasgow University in 1923, he came to the United States. For two years he was assistant professor of experimental engineering at Georgia Tech., two years as assistant professor of engineering drawing at Virginia Tech., and eight years at Harvard Graduate School of Engineering as national research fellow and instructor. Then for four years he was executive engineer of research and development for The Budd Manufacturing Co. in Philadelphia, from which he resigned to go to the United Shoe Machinery Corp. research division. In that corporation he was for three years chief engineer of the aircraft section and later head of the engineering department. He has degrees from Georgia Tech, Virginia Tech and Harvard University.

Recently a short course in surveying and mapping was given at the Georgia School of Technology. It was offered by the department of civil engineering and the extension division under the sponsorship of the American Society of Civil Engineers, American Society of Engineering Education, American Congress on Surveying and Mapping, and the American Society of Photogrammetry.

Imperial Oil, Ltd., Toronto, Ont., has awarded four research fellowships, each valued at $3,000, open to graduates in Canadian Universities, for studies leading to the master's or doctor's degree in engineering.



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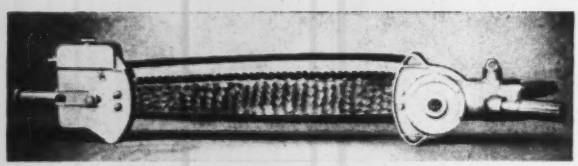

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Elections and Activities

The Lincoln Chapter of the Pennsylvania Society of Professional Engineers received its charter from LeRoy F. Christman, Reading, president of the State Society at the February meeting in York, Pa. Officers are: Thomas A. Monk, Jr., of the firm of Monk & Roth, engineers and architects, York, president; H. C. Kern, Pennsylvania Water & Power Co., Safe Harbor, vice president; Kenneth E. Rockhold, C. C. Kottcamp & Son Co., York, secretary; Robert S. Mayo, construction engineer, Lanscaster, treasurer; F. H. Shaw, construction engineer, Lancaster; E. W. Ficks, John H. Wickersham Co., Lancaster; Jacob L. Mueller, Mueller Engineering Co., York; James K. Towers, Hardinge Manufacturing Co., York; Henry F. Huth, consulting engineer, Pequea; J. H. Shertzer, city engineer, Lancaster, and Joseph A. Nichels, York Industries, York, directors.

T. A. Monk, Jr.

One of the projects of the Lincoln Chapter is the modernization of the building code in the various cities in which the members are located. Membership in the chapter comes from York, Adams, Franklin and Lancaster counties, all located along U. S. route 30, the Lincoln Highway.

The Kansas Engineering Society has elected Robert Willis, of the Kansas Highway department, Topeka, president for the ensuing year.

A. R. Burbeck has been elected president of the Home Builders Association of Greater Akron, Ohio, with Phil J. Franz, vice-president; Harold M. Carson, secretary-treasurer, and C. R. Miller, Phil J. Franz, Gus Kalstrom, and Paul Novak as trustees.

The following officers have been elected for the Texas Waterworks and Sewerage Short School: S. C. Allison, Corpus Christi, president; R. M. Dixon, College Station, N. G. Trostle, Temple, K. V. Stutz, McCamey, and E. J. Umberhauer, El Paso, vice-presidents; V. M. Ehlers, Austin, secretary and treasurer;

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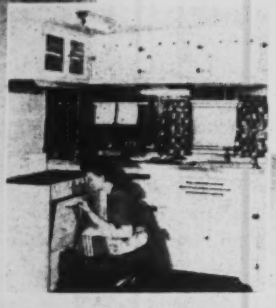

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and Mrs. Pearl Goodwin, Austin, assistant secretary and treasurer.

Ontario Good Roads Association has elected W. J. Moore of Renfrew, president and A. J. Emery, Waterloo, and V. H. Timmins as vice-president.

Chauncey L. Marley, road commissioner of Ontonagon County, has been elected president of the County Road Association of Michigan. L. E. Kaufman, Grand Rapids, secretary of the Kent County road commission, was re-elected secretary-treasurer. Vice-president is L. C. Smith of Detroit, engineer-manager of the Wayne County Road Commission. Directors chosen also included Frank K. Evans, Lansing, engineer-manager of the Ingham County road commission, and Charles T. Lathers, Cheboygan, road commissioner of Cheboygan County.

A. M. Kircher, city engineer of Mankato, Minn., is president of the Minnesota Association of Professional Engineers, and Paul R. Speer, St. Paul, water resources engineer, U. S. Geological Survey, is president of the Minnesota Federation of Engineering Societies. Other officers of the latter are: Garold Felland, Minneapolis, first vice-president; Hugo Schlenk Jr., Cloquet, second vice-president; E. S. Ward, Willmar, third vice-president; and John L. Wilson, St. Paul, secretary-treasurer.

J. L. E. Price, civil engineer and general contractor of Montreal, Que., has been elected chairman of the Canadian Legion National Housing Committee and chairman of the Canadian Construction Association housing committee. Mr. Price is a veteran of the war, a contractor of long experience and is past president of the National House Builders Association.

Marvin Kahl, Jr., is the new president of the Evansville, Ind., College Engineering Club. Other officers are Charles Nochland, vice-president; Charles Hughes, Jr., secretary, and Frank Hayes, treasurer. All three are freshmen. J. A. Needy, director of engineering education and technology, is the group's sponsor.

E. B. Crane, an assistant engineer of the Milwaukee Road, has been elected president of the Seattle, Wash., section of the American Society of Civil Engineers. With B. P. Thomas of the Army Engineers as vice-president and T. H. Campbell, Jr., assistant professor of hydraulics at the University of Washington, secretary-treasurer. Life membership certificates have been awarded to Ray Murray of the Seattle Engineering Department; Oscar A. Piper, also

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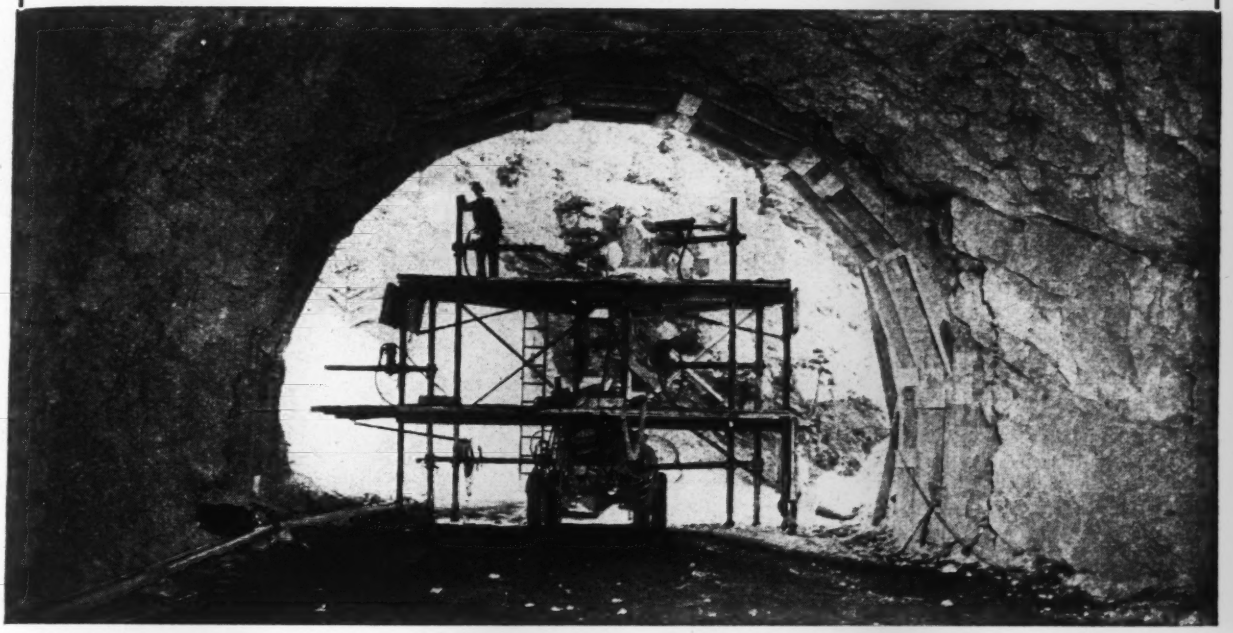

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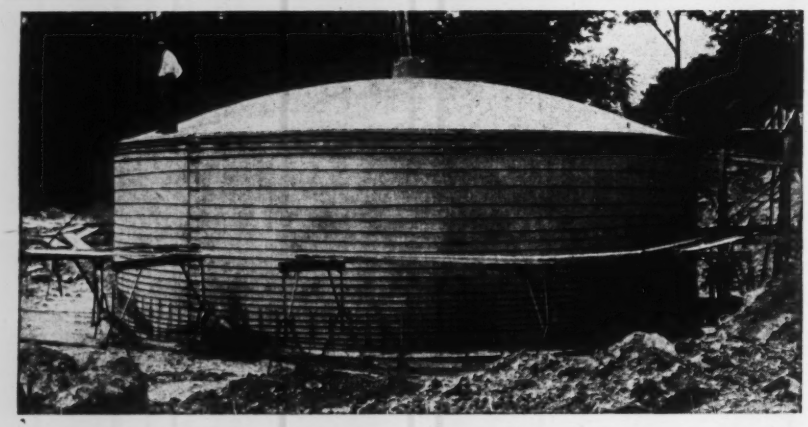

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with the department until the war, when he went to the Army Engineers; Melvin D. Williams, who retired Dec. 31 after 50 years as a civil engineer for various government organizations or in private practice; and Hans Mumm, Jr., of Everett, former engineer for the Port of Everett.

W. A. Rounds of Fort Worth has been named president of the Texas Society of Professional Engineers. T. C. Forrest, Jr., of Dallas, is a member of the national board of directors.

The following 1947 officers for the Central East Texas Water Works and Sewerage Association have been chosen: Jack Lloyd, of Tyler, president; Jack Horner, of Henderson, vice president; B. Underhill, of Jacksonville, secretary and treasurer; and B. Collins, of Carthage, group leader.

Frank Blanchard, of Rose Hill, N. C., has been elected president of the North Carolina Society of Land Surveyors. Pittman Stell, of Zebulon, was named vice-president, and Richard Seawell of Raleigh, secretary.

E. H. Walpole, of Oklahoma City, has been installed as the new president of the Oklahoma chapter of the Associated General Contractors of America. Other officers installed were: W. R. Grimshaw, of Tulsa, vice-president; R. E. Mattison, of Briton, 2nd vice-president; Walter Nashert, of Oklahoma City, treasurer; and H. R. Jensen, of Oklahoma City, secretary.

Stuart S. Wilson has been installed as president of the Seattle Construction Council, with Henry W. Farrington as vice-president, Ralph Lane, secretary, and E. E. Saberhagen, treasurer.

Otto Buehler, Dover, has been elected president of the Ohio Brick and Tile Institute, succeeding C. M. Shafer, of New Philadelphia, C. Forrest Tefft, Columbus, was elected vice-president.

Formation of the Columbus, Ohio, Concrete Block Manufacturers' Association has been completed. Officers are: Robert G. Kern, Columbus Builders Supply, Inc., president; John M. Swickard, Swickard and Crissman, vice-president; and John F. Royer, secretary.

Officers of the Pennsylvania Society of Professional Engineers are: LeRoy F. Christman, Reading, president (re-elected); William G. Bush, Philadelphia, Martin C. Knable, Pittsburgh, Mark E. Smith, Erie, and Victor J. Snyder, Harrisburg, vice-presidents; Walter E. Witte, Philadelphia, treasurer; Alfred A. Townsend, Philadelphia,

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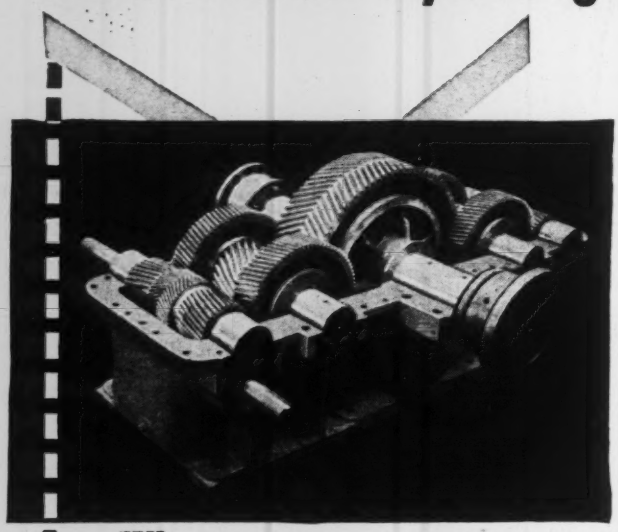

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assistant treasurer; William Nelson Smith, Reading, historian, and Victor J. Snyder, Harrisburg, executive secretary.

Homer H. Harris, Alexandria, La., has been named president of the Red River Valley Improvement Association. Walter Jacobs, Shreveport, was named executive vice-president, George T. O'Neal, Hugo, Okla., W. T. Murphy, Texarkana, Ark., and A. G. Mayse, Paris, Texas, vice-presidents. Val H. Murrell, Shreveport, secretary-manager.

New 1947 officers of the Iowa Engineering Society are: President: Frank Kerekes, Department of Civil Engineering, Iowa State College, Ames, Iowa; President-elect: Wm. P. Nemmers, Des Moines, Iowa; vice-president, C. M. Stanley, Stanley Engineering Co., Muscatine, Iowa; Directors: L. C. Crawford, Hydraulics Laboratory, Iowa City, Iowa; Robert S. Casey, Research Laboratory, W. A. Sheaffer Pen Co., Fort Madison, Iowa; secretary: A. F. Faul, Iowa Highway Commission, Des Moines, Iowa; treasurer: E. F. Behrens, Des Moines, Iowa.

Frank Parkin Flatt, C.E. graduate of New Brunswick University and chief engineer of the Truscon Steel of Canada, Ltd., is president of Toronto Builders Exchange.

Edmund R. Hodson, Hillsboro, has been elected president of the Southern Ohio chapter of Ohio Society of Professional Engineers, an 8-county group. Others elected were: W. R. Shumaker, West Union, vice-president; Rayburn Horsman, Highland, secretary; and H. H. Alexander, Chillicothe, treasurer.

The Wisconsin Builders' Association was organized at a meeting in Milwaukee of 36 builders from that city, Madison, Oshkosh, Beloit, Kenosha, Watertown, La Crosse, Fond du Lac and Janesville. Officers are: Sidney Dwyer, Milwaukee, president; Neal H. Stoddard, Madison, vice-president; Glenn Webermeier, Beloit, secretary; John Parmentier, Kenosha, treasurer, and Frank Kirkpatrick, Milwaukee; Joseph Callaway, La Crosse, and E. A. Precour, Oshkosh, directors.

A group of 250 state, county and city highway engineers, Illinois state officials and representatives of materials companies assembled recently on the Champaign-Urbana campus of the University of Illinois for a 3-day conference upon the problems of highway and street construction and maintenance. Prof. C. C. Wiley, department of civil engineering, and head of the division of

highway engineering, was in charge. The student chapter, American Society of Civil Engineering, served as directors of information and registration. Cooperating with Prof. Wiley and the entire department of civil engineering of the university were the Illinois Division of Highways and the Illinois Association of County Superintendents of Highways.

New president of the Mountain Pacific chapter, Associated General Contractors, at Seattle, Wash., is Paul Fiorito. Wayne Sutton is vice-president, Paul C. Fredrickson, who has been with the General Construction Co. since his release from the Army in May, has been named manager of the chapter.

Officers of the Allied Construction Industries of Delaware, Inc., have been re-elected as follows: President, John E. Healy, Jr.; vice-president, James P. Robbins, Jr.; secretary-treasurer, Robert H. Armstrong, and executive vice-president and manager, Francis E. B. McCann. Directors named are: Frederic G. Krapf, Richard Reed, George Griffith Smith, Hugh Blackwell; Dominick DiSabatino, Graydon Hurst, James Cullen, Arthur Pavoni, E. F. Higgins, Joel H. Megonigal, Winfield Stewart, Glenn B. Hoffheiser, William Mink, E. P. Lowe, Joseph Ward, William Savory, Samuel McCormick, George W. Buffington, J. Francis Blaine, Charles Zimmerman, Samuel Bateson, and Herbert F. Weldin.

National officers elected to head the new Forest Products Research Society are Fred W. Gottschalk, Chicago, Ill., technical director, American Lumber and Treating Co., president; George A. Garratt, New Haven, Conn. Dean, School of Forestry, Yale University, vice-president; William J. Baker, Madison, Wis., Technologist, U. S. Forest Products Laboratory, secretary-treasurer; and Bror L. Grondal, Seattle, Wash. Professor of Forestry, University of Washington, past organizational chairman. Six regional board members, to serve terms ranging from one to three years, include Edward G. Locke, Portland, Ore., chemical engineer, U. S. Forest Service, Northwest; James F. Hamilton, Philadelphia, Pa. Technical service director, Perkins Glue Co., Northwest; Jac. H. Tigelaar, Grand Rapids, Mich., director of research and tests, Haskelite Mfg. Corp., North-Central; Robert A. Cockrell, Berkeley, Calif., associate professor of forestry, University of California, Southwest; Carl A. Rishell, Washington, D. C., director of research, National Lumber Manufacturers Association, Southeast; and Kenneth G. Chesley, Crosset, Ark., director of research, Crossett Lumber Co., South-Central.

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FRAMING ANCHORS

These economical, scientifically developed secondary connectors for lumber framing are as revolutionary for housing as TECO connectors were 13 years ago in turning timber into an engineering material.

Here are a few of the advantages over old fashioned, expensive methods:

- Toe nailing uncertainties eliminated.
- Bridging eliminated in attaching joists to trusses.
- Stronger in supporting joists against ledgers or beams.
- Notching eliminated.
- Wind anchorage effected.
- Saves material, every nail performs to full capacity.
- Saves costs connecting joists to walls—ledgers to beams.
- Eliminates ledger strip.

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Specify TECO TRIP-L-GRIP ON YOUR HOUSING

TIMBER ENGINEERING CO. 1319 - 18th STREET, N. W. WASHINGTON 6, D. C.

Please send me FREE copy of your new booklet on TECO TRIP-L-GRIP Framing Anchors and quote prices.

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This new publication describing meters for sewage, industrial wastes, sludge and irrigation water should be part of your file on flow measurement. Ask for Bulletin 62.

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MOTT CORE DRILLING CO.
HUNTINGTON, W. VA.

Reports and Pamphlets

(*Continued from page 96*)

CONNECTICUT'S ROAD PROGRAM—State Highway Department, Hartford, Conn.

AMERICAN TRUCKING—MOTOR TRUCKS FACTS AND FIGURES—American Trucking Associations, Inc., Washington 6, D. C.

HOUSING IN FRONT ROYAL VIRGINIA—Facts and Trends—The American University, Washington, D. C.

ENGINEERING FACTS AND A FUTURE ROAD PROGRAM—A study for the California Legislature. Automotive Safety Foundation, 700 Hill Building, Washington 6, D. C.

MAPS OF THE MISSISSIPPI RIVER—1946 Edition—The President, Mississippi River Commission, Vicksburg, Miss. 75c.

THE PROBLEM OF THE URBAN INTERSECTION—District of Columbia, Department of Highways, Washington, D. C.

FLOODS IN OHIO; FREQUENCY AND MAGNITUDE—Bulletin No. 7, Ohio Water Resources Board, Columbus, Ohio.

GROUNDWATER IN THE FARGO-MOORHEAD AREA, North Dakota and Minnesota—U. S. Department of the Interior, Washington, D. C.

REINFORCED CONCRETE BUILDINGS AND STRUCTURES—Report on Formulae for Computation of Stresses. The Institute of Structural Engineers, London, SWI. Price 1s.

A QUALATIVE TEST FOR CEMENT-AGGREGATE REACTION—A reprint from the *Journal* of the Council for Scientific and Industrial Research, Fisherman's Bend, S. C. 8, Australia.

AMERICAN STANDARDS—A revised list of standards of the American Standards Association (with prices) issued by the association, 70 East 45th St., New York 17, N. Y.

THIRTY YEARS IN SCARSDALE — By Fred Lavis, Consulting Engineer, Scarsdale, N. Y.

MUNICIPAL PROVISIONS FOR PARKING FACILITIES—State Laws and City Projects. Bureau of Business Research, Ohio State University, Columbus, Ohio. $1.25.

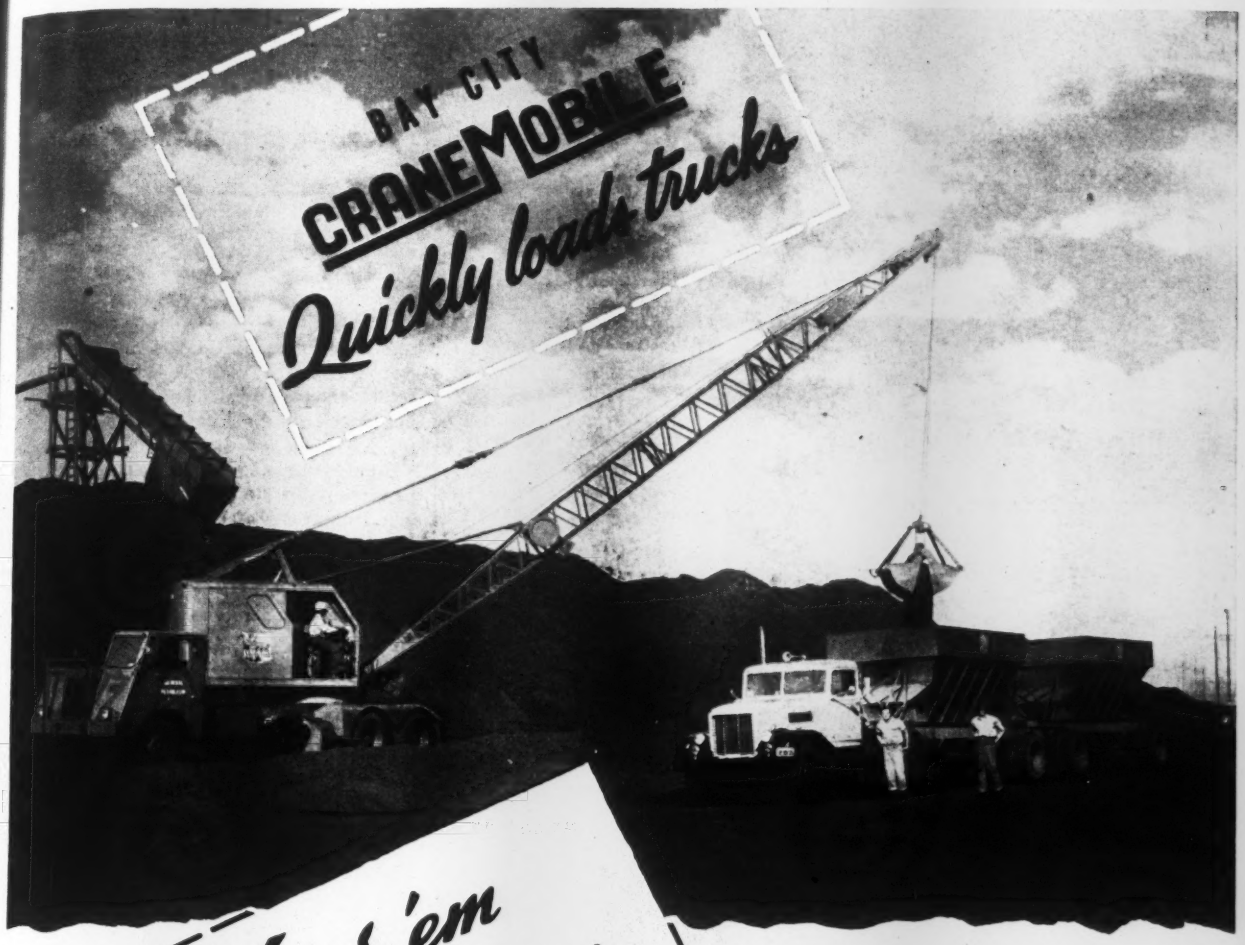
HIGHEST AND LOWEST ANNUAL STAGES—Mississippi River and its Outlets and Tributaries. Mississippi River Commission, Vicksburg, Miss.

BASIC CRITERIA USED IN WAGE NEGOTIATIONS—The Chicago Association of Commerce and Industry, 1 North LaSalle St., Chicago 2. 50c.

ACHIEVEMENTS IN MANY RELATED FIELDS—The Dravo Corporation, Pittsburgh, Pa.

MAPS OF THE WHITE RIVER (1946), and MAPS OF THE ST. FRANCIS RIVER, (1946). Mississippi River Commission, Vicksburg, Miss. 50c and 55c. respectively.

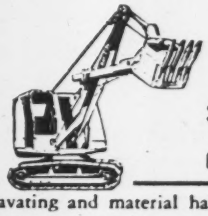
LOCAL GOVERNMENT REPORTING IN MARYLAND—By R. Uhl. Maryland State Planning Commission, 104 Equitable Bldg., Baltimore 2, Maryland.



Keeps 'em rolling... AT CALIFORNIA COKE YARD

Is loading trucks quickly and profitably one of your material handling problems? This BAY CITY CraneMobile loads 22 tons of coke from pile into trailer-trucks in from ten to fifteen minutes at the yards of the General Petroleum Co., Torrance, California. It's a Model 180T-60 CraneMobile, equipped with a 1-yard bucket at the end of the 50 ft. boom which permits fast, easy loading of railroad cars as well as trucks. There's a BAY CITY CraneMobile or Crawler Crane to speed and simplify your material handling and excavating jobs. See your nearest BAY CITY dealer or write direct. BAY CITY SHOVELS INC., Bay City, Michigan.

BAY CITY



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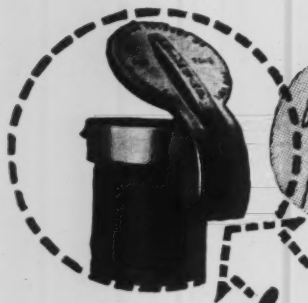
SEE YOUR NEAREST DEALER for Bay City excavating and material handling equipment in sizes from ⅜ to 1¼ yards having crane rating up to 20 tons. Both crawler and pneumatic tire mounting.



RAINCAP

New!

THE CAP THAT DOES NOT FORGET TO CLOSE
Completely automatic—the "RAINCAP" is counterbalanced to open when the tractor starts and close when it stops. Rust proof — made of cast aluminum — can be installed in two minutes. F.O.B. Waterloo, Iowa. Prices subject to change without notice.

Dealers Wanted

STOPS MOISTURE FROM FALLING INTO TRACTOR EXHAUST . . Just slip the "RAINCAP" over the open end of your tractor exhaust, and you eliminate forever the danger of moisture falling into the exhaust, injuring your tractor.

Outside Diameter Exhaust	*Caterpillar Model*	*Price*
1½"	Starting Motor	$1.90 plus tax
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3"	D7	2.50 plus tax
3"	D8	2.50 plus tax

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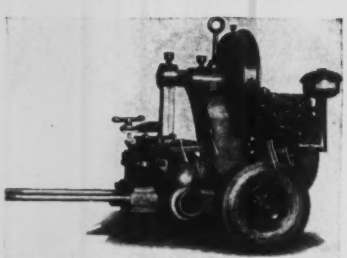

Rugged! Yes, it's rugged alright. Countless testimonials make us proud in the knowledge that here is a pump that's tough enough to stand up under the harshest treatment! Designed to be able to "take a beating" CARTER offers for your most exacting demands a complete line of humdinger diaphragm pumps. See for yourself!!

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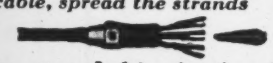
RALPH B. CARTER CO.
HACKENSACK, NEW JERSEY
53 PARK PLACE, NEW YORK 7, N. Y

GOES ON IN NO TIME

HANGS ON FOR ALL TIME

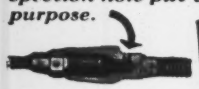
. . . this *Electroline* FIEGE
WIRE ROPE CONNECTOR

See how easily it goes on—simply slide the sleeve on the cable, spread the strands



insert and drive in the plug and apply the socket

Then see what a solid and permanent joint you have by looking at it through the inspection hole put there for the purpose.



This better connector damps vibration, prolongs wire rope life; is in fact the STRONGEST PART of a wire rope assembly.

Electroline Company
4121 SOUTH LASALLE STREET
CHICAGO 9, ILLINOIS

Manufacturers' Activities

At the annual meeting of Rockwell Manufacturing Co., Pittsburgh, Pa., the board of directors elected W. F. Rockwell, Jr., president. He formerly served as vice president and general manager. Col. Willard F. Rockwell will retain the office of chairman of the board. All other officers were re-elected.

Appointment of Harry B. Cummings as manager of the tar department of the Tar Products Division of Koppers Co., Inc., has been announced. His new duties will include direction of the production and sale of various tar products, including road and roofing materials, preservatives, pitches, acids, bases, naphthalene, oils, and other products. The tar department also handles the sales of the coated metal sheets produced by the Coated Products Department.

John C. Painter has been appointed district representative of The Galion Iron Works & Mfg. Co., manufacturers of rollers and motor graders, to cover the states of North and South Carolina, Florida and Georgia.

Appointment of Frederick C. Brandt as sales manager of the air conditioning controls division for the Minneapolis-Honeywell Regulator Co., in the southwestern region has been announced. He will make his headquarters in Houston at the company's regional office, 1309 Capitol Ave.

W. A. Rundquist has been appointed sales promotion manager for Pioneer Engineering Works, Inc., Minneapolis, Minn., to have charge of advertising, sales promotion, and sales training. The company manufactures heavy equipment for the quarry, gravel, mining, and paving industries.

Purchase of the Woodhouse Chain Works, Trenton, N. J., by the Cleveland Chain & Manufacturing Co., Cleveland, has been announced. The Trenton plant will continue in full operation as the Woodhouse Chain Works Division of the Cleveland Chain & Manufacturing Co. E. S. Washburn, present plant manager, will remain in the same capacity under the new setup.

Appointments of Charles S. Hegel as manager of the stainless steel di-

ion, and JOHN W. QUEEN as manager the alloy steel division of Joseph T. erson & Son, Inc., steel distributors, e been announced. They are lo- ed at the Chicago plant of the com- ny. G. Van Dyke, former head of Ryerson Special Steels Division, re- d December 31, 1946 after 30 years' vice with the organization. Albert J. uer has been made sales representa- e in the Rocky Mountain states, with adquarters in the Denver National dg., Denver, Colo. E. F. Wood has en assigned as manager of the work der department at the Los Angeles el-service plant.

UNITED STATES PLYWOOD CORP. is upying its new Detroit branch office d warehouse on 6845 Dix Road near rnor Highway. The new office and rehouse cover 40,000 sq. ft. on 2.3 es of land.

DRAVO CORPORATION, Pittsburgh, ., has announced the appointment of R. Berg as manager of the heating d combustion sections of the ma- inery division. The heating section anufactures and markets nationally e Dravo Counterflo oil or gas-fired ater for industrial and commercial e, and the combustion section fur- shes and installs in western Pennsyl- nia Iron Fireman stokers, Cleaver- ooks boilers, Todd oil burners, hirlex fly-ash arrestors and other mbustion equipment.

Hewitt Rubber division of HEWITT- OBINS, INC., has announced the ap- intment of the Hawaiian Equipment o. Ltd., Honolulu, as its distributor the complete Hewitt line of indus- ial hose and belting throughout the awaiian Islands. The first supply use of its kind to be established on e Islands, the new company is di- ted by W. P. Sheehan, vice-president d general manager.

THE CLAY SEWER PIPE ASSOCIATION, C., announces the opening of an office 117 W. Genesee Ave., Saginaw, ich. C. J. Bauer, Jr., district engi- er of the association, and its Michigan epresentative for the past six years, ill maintain his headquarters at the w address.

CONSOLIDATED INDUSTRIES, INC., La- ette, Ind., manufacturers of auto- atic heating and low temperature ezing products, has announced the ppointment of W. W. Timmis as gen- al sales manager.

DAVEY COMPRESSOR CO., Kent, Ohio, ently announced the following ap- intments: F. S. Ray Co., Houston, ex., as a distributor to handle the

How to put your suppliers in your own "back yard"

It's like having all your suppliers right at hand, when you specify shipment by Air Express. Even coast-to-coast deliveries of supplies and parts are now routine. When you're in a rush for something, big or little, let Air Express solve your problem.

With more and bigger planes in service, Air Express schedules are more frequent. But the cost of this faster service is low. There is *profit* for you in the speed of Air Express, so use it regularly!

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Rates are low

To Air Express an 18-lb. shipment **849** miles costs only **$4.42!** Heavier weights — any distance — are similarly inexpensive. Investigate!

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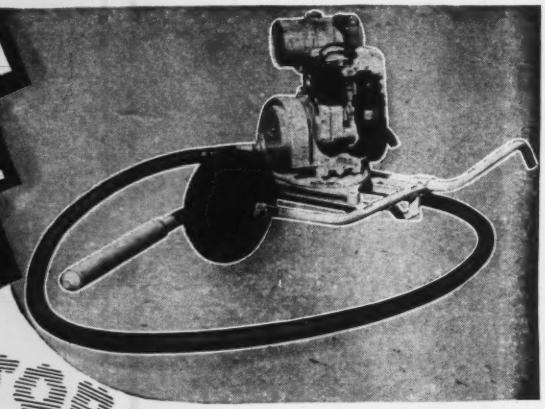
FLEXIBLE
SHAFT
VIBRATORS



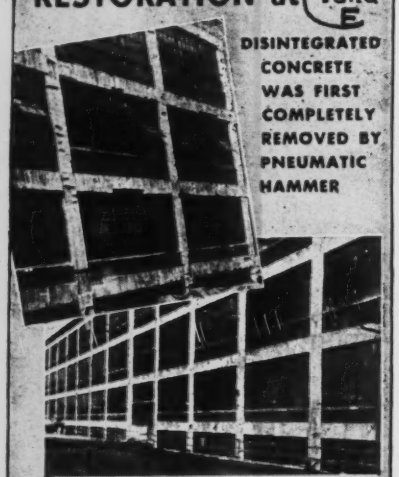
Excellent FOR BOTH THICK AND THIN CONCRETE SECTIONS

This husky, self-contained, trouble-free unit, powered by a thoroughly dependable Wisconsin engine with automatic clutch, may be had with three vibrator heads for thick and thin sections, flexible shafting (½" core) in 7 to 14' lengths up to 28 ft. Full swivel, dirt-proof base. Variable speed control up to 7500 V.P.M. Wheelbarrow with drop handles is optional.

The JACKSON line contains the ideal vibrator (internal or external, hydraulic, flexible shaft engine or electric motor driven) for every type of concrete construction. Write for information on the type you are interested in.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

PRESSURE CONCRETE RESTORATION at Y and E



DISINTEGRATED CONCRETE WAS FIRST COMPLETELY REMOVED BY PNEUMATIC HAMMER

NOW COMPLETELY RESTORED BY PRESSURE CONCRETE – (BEFORE APPLICATION OF PROTECTIVE COAT)

The Y and E plant at Rochester, N. Y. is but one of the many organizations using the PRESSURE CONCRETE method of Hudson-Rumsey Co., Inc. for building maintenance.

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HUDSON-RUMSEY CO. INC.
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DE LAVAL was the first to popularize the centrifugal pump for water works service.

DE LAVAL is first choice of American cities. 78 per cent of all cities of over 100,000 population use De Laval pumps.

DE LAVAL is first in efficiency and reliability.

DE LAVAL WW2
STEAM TURBINE CO. TRENTON 2, NEW JERSEY

complete Davey line. Claude B. Smith Co., San Francisco, Calif., has been made Northern California distributor of Davey compressors, with complete sales and service facilities on all items of Davey manufacture. J. T. Myers has been elected vice president of the Davey Compressor Co., in charge of sales and production.

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the appointment of seven new welding sales engineers: Marvin Anderson, appointed to the Moline, Ill., office; Albert Bavaria, Philadelphia; Richard Freundlich, Cleveland; Paul Holden, Franklin, Pa.; Richard Nelson, Syracuse, N. Y.; Richard K. Reynolds, Detroit.

FRANK C. MCMANUS, former factory manager of the Long Island City, N. Y., plant of Mack trucks, has been appointed factory manager of the Fuller Manufacturing Co., Kalamazoo, Mich. Mr. McManus comes to the Fuller company, makers of heavy-duty transmissions, with nearly 30 years of experience in automotive work and plant supervision.

Three promotions within the sales department of Republic Rubber Division, LEE RUBBER & TIRE CORP., Youngstown, Ohio, have been announced: New sales manager and department head is G. L. Smith; Myron C. Myer, traveling sales manager; Ralph W. Deemer assistant sales manager.

The water heater division of the A. O. SMITH CORP., has been moved from Milwaukee, Wis., to the company's new $3,500,000 water heater plant at Kankakee, Ill.

A. S. MARLOW, SR., president, Marlow Pumps, Ridgewood, N. J., was elected chairman of the Contractors' Pump Bureau for 1947. He succeeds John H. Hase, C. H. & E. Manufacturing Co., Milwaukee, Wis.

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, announces new locations of its branch offices at 1302 Stanford Ave., Emeryville 8, Calif.; 1500 Calzona St., P. O. Box 7336, Station L, Los Angeles 23, Calif.; and 113 North 9th St., Birmingham, Ala.

Two changes in its sales organization have been announced by the JONES & LAUGHLIN STEEL CORP., Pittsburgh, Pa.: Kier M. Boyd assistant manager of sales, strip and sheet products; Charles Potter manager of the J & L Pittsburgh warehouse, succeeding J. M. Hilbish who has retired after 28 years of service with the company. Mr. Potter's entire business career has been with the steel industry.

Design for Durability

Where grueling conditions hamper e performance of your power cables will pay you to specify Simplex-IREX* as standard equipment for all ortable machinery.

From the insulating process to e final jacketing, each step in the anufacture of TIREX "builds in" a urability no other cables excel. It is is toughness which makes every pur-ase of TIREX an investment in long, nfailing service.

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1 The **Insulation** of the conductors is an electrically stable compound designed to withstand the wear and tear of heavy duty work.

2 The **Inner Jacket** of tough, high quality rubber holds the conductors in position yet does not reduce their flexibility. It is overlaid by

3 Two **Seine Twine Serves** which are hard-twisted for strength. These reinforcing serves are imbedded between the inner jacket and

4 The **Outer Jacket** of Selenium-Neoprene Armor. When the cable is vulcanized, serves and jackets are fused to form a single shield comparable in construction and superior in wearability to the automobile tire. The exclusive Selenium-Neoprene Armor resists the abuse of harmful abrasives and the action of sunlight, moisture, oils, and alkalies. It will not support combustion.

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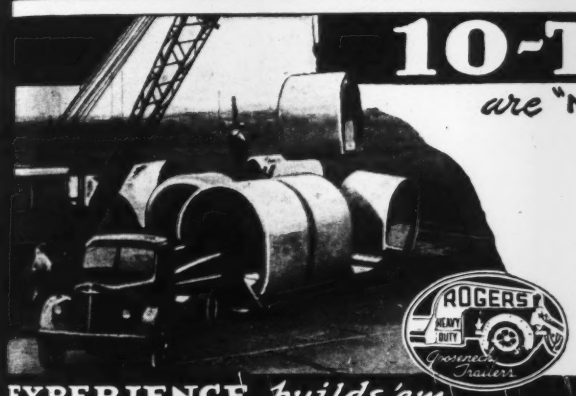
SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.,

10-TON CULVERT SECTIONS

are "MADE TO ORDER" for this

ROGERS TRAILER



The broad, sturdy deck of this Rogers trailer readily accommodated four huge culvert sections. This 40-ton load was swiftly and easily transported to the construction location.

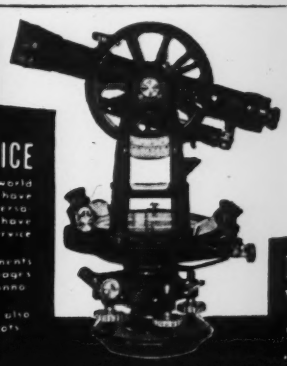
Write for the catalog illustrating a complete range of sizes and types.

ROGERS BROTHERS CORPORATION
135 ORCHARD STREET ALBION, PENNA.

EXPERIENCE *builds 'em* PERFORMANCE *sells 'em*

White

TRANSITS LEVELS ALIDADES



Illustrated, famous Type II Transit No. 7014. Telescope 11½" long — internal focusing — 24 power. Horizontal limb graduated to ½ degrees, Verniers to 1 minute, 6½" diam.

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Used on major construction jobs the world over, White construction instruments have not only proven superior in accuracy, versatility and precision engineering but have proven their worth in continued service under difficult conditions!

Rugged — dependable — White instruments feature coated optics of sharper images among other engineering and optical innovations.

Write today for full details and prices also free booklet "How To Lay Out Building Lots"

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..Enough to do most jobs

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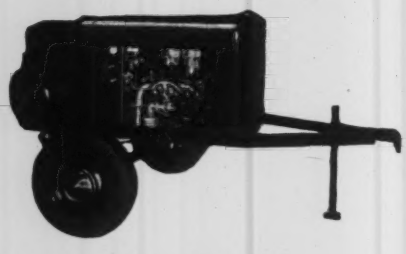
ECONOMY



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Why pay for needless power with oversize, expensive compressors? A lightweight Smith Compressor will do the majority of your compressor work —at less cost. Use it to run medium weight rock drills, paving breakers, clay spades, large spray guns. Capacity 60 cu. ft.—easily varied for different jobs.

Uses only 1 gal. of gas an hour. Automatic unloading and idling; self-starting. No couplings, belts, clutches or gears. Tow it at truck speeds from job to job. Ford motor and standard parts insure ready servicing anywhere.

Why not get all the facts about Smith Air Compressors? Write, phone or wire today.

GORDON

Smith

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430 College St. **Bowling Green, Ky.**

Manufacturers' Publications

Tractor—(32-p. catalog) Covers features of diesel D7 tractor. Photographs and specifications are included.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Power Transmission and Conveyor—(General catalog) Gives complete descriptions, data and prices for many nationally known lines of speed reducers, gears, belts, chain drives, bearings, flexible couplings, pulleys, electrical motors, power and gravity conveyors and items distributed by this company. — *Patron Transmission Co., 120 Grand St., New York, N. Y.*

Magnetic Pulleys — (Catalog 303) Contains descriptive data, specifications, information on selecting for proper size, material, capacities, trajectory charts, and use of double magnetic pulleys, as well as application suggestions and pictures.—*Stearns Magnetic Mfg. Co., Milwaukee 3, Wis.*

Roof Construction—(Two catalogs) Shurebond unit system of concrete joist construction is described in 32-p. catalog, while 12-p. bulletin gives data on Metrodeck, metal roof deck with tapered rib.—*Goldsmith Metal Lath Co., Cincinnati 2, Ohio.*

Protective Packaging — (12-p. brochure) Outlines uses and advantages of "Cocoon", new process for packaging anything from ball bearing to locomotive.—*R. M. Hollingshead Corp., Camden, N. J.*

Steel Forms—(Two 4-p. folders) Describes steel forms for house and building foundations and for concrete walls and roofs.—*Irvington Form & Tank Corp., Irvington, N. Y.*

Official Design Standards — (40-p. booklet) "Specification for the Design of Light Gage Steel Structural Members" covers results of studies begun in 1939 at Cornell University. It consists of design provisions governing shapes made up of flat or straight elements such as are most commonly encountered in the design of structural members formed of light-gage steel. Endeavor has been made to simplify design procedure by including design tables, curves and charts, also illustrative examples. Specification has four appendices which deal with problems of application of the specification. Other features are: Material qualifications, de-

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